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PASSAIC RIVER BASIN
DARLINGTON BROOK, BERGEN COUNTY
NEW JERSEY

AD A088255

DARLINGTON LAKE DAM

NJ 00230

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AUG 26 1980
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PHASE 1 INSPECTION REPORT NATIONAL DAM SAFETY PROGRAM



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10/ John P. Talerico

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number) This report cites results of a technical investigation as to the dam's adequacy. The inspection and evaluation of the dam is as prescribed by the National Dam Inspection Act, Public Law 92-367. The technical investigation includes visual inspection, review of available design and construction records, and preliminary structural and hydraulic and hydrologic calculations, as applicable. An assessment of the dam's general condition is included in the report.		

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PHILADELPHIA DISTRICT, CORPS OF ENGINEERS
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PHILADELPHIA, PENNSYLVANIA 19106

11 AUG 1980

Honorable Brendan T. Byrne
Governor of New Jersey
Trenton, New Jersey 08621

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Dear Governor Byrne:

Inclosed is the Phase I Inspection Report for Darlington Lake Dam, in Bergen County, New Jersey which has been prepared under authorization of the Dam Inspection Act, Public Law 92-367. A brief assessment of the dam's condition is given in the front of the report.

Based on visual inspection, available records, calculations and past operational performance, Darlington Lake Dam, initially listed as a high hazard potential structure, but reduced to a significant hazard potential structure as a result of this inspection, is judged to be in good overall condition and the dam's spillway is considered adequate. To ensure adequacy of the structure, the following actions, as a minimum, are recommended:

a. Within six months from the date of approval of this report, the owner should develop an emergency action plan outlining actions to be taken by the operator to minimize downstream effects of an emergency and establish a flood warning system for the downstream communities.

b. The flow of seepage noted on the parking area downstream of the embankment, opposite the main spillway, should be monitored monthly to determine its volume and whether it presents a problem to the safety of the dam.

c. The existing dam plans and drawings should be annotated and updated to form a coherent as-built set within two years from the date of approval of this report.

d. The owner should develop written operating procedures and a periodic maintenance plan to ensure the safety of the dam within one year from the date of approval of this report.

NAPEN-N

Honorable Brendan T. Byrne

A copy of the report is being furnished to Mr. Dirk C. Hofman, New Jersey Department of Environmental Protection, the designated State Office contact for this program. Within five days of the date of this letter, a copy will also be sent to Congressman Maguire of the Seventh District. Under the provision of the Freedom of Information Act, the inspection report will be subject to release by this office, upon request, five days after the date of this letter.

Additional copies of this report may be obtained from the National Technical Information Services (NTIS) Springfield, Virginia 22161 at a reasonable cost. Please allow four to six weeks from the date of this letter for NTIS to have copies of the report available.

An important aspect of the Dam Inspection Program will be the implementation of the recommendations made as a result of the inspection. We accordingly request that we be advised of proposed actions taken by the State to implement our recommendations.

Sincerely,



JAMES G. TON
Colonel, Corps of Engineers
District Engineer

1 Incl
As stated

Copies furnished:
Mr. Dirk C. Hofman, P.E., Deputy Director
Division of Water Resources
N.J. Dept. of Environmental Protection
P.O. Box CN029
Trenton, NJ 08625

Mr. John O'Dowd, Acting Chief
Bureau of Flood Plain Regulation
Division of Water Resources
N.J. Dept. of Environmental Protection
P.O. Box CN029
Trenton, NJ 08625

DARLINGTON LAKE DAM (NJ00230)

CORPS OF ENGINEERS ASSESSMENT OF GENERAL CONDITIONS

This dam was inspected on 13 November and 3 December 1979 by Harris-ECI Associates, Inc., under contract to the State of New Jersey. The State, under agreement with the U.S. Army Engineer District, Philadelphia, had this inspection performed in accordance with the National Dam Inspection Act, Public Law 92-367.

Darlington Lake Dam, initially listed as a high hazard potential structure, but reduced to a significant hazard potential structure as a result of this inspection, is judged to be in good overall condition and the dam's spillway is considered adequate. To ensure adequacy of the structure, the following actions, as a minimum, are recommended:

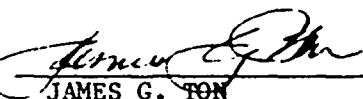
a. Within six months from the date of approval of this report, the owner should develop an emergency action plan outlining actions to be taken by the operator to minimize downstream effects of an emergency and establish a flood warning system for the downstream communities.

b. The flow of seepage noted on the parking area downstream of the embankment, opposite the main spillway, should be monitored monthly to determine its volume and whether it presents a problem to the safety of the dam.

c. The existing dam plans and drawings should be annotated and updated to form a coherent as-built set within two years from the date of approval of this report.

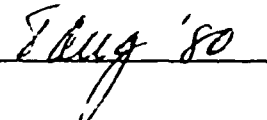
d. The owner should develop written operating procedures and a periodic maintenance plan to ensure the safety of the dam within one year from the date of approval of this report.

APPROVED:


JAMES G. TON

Colonel, Corps of Engineers
District Engineer

DATE:


1 Aug '80

PASSAIC RIVER BASIN
DARLINGTON BROOK, BERGEN COUNTY
NEW JERSEY

DARLINGTON LAKE DAM

NJ00230

PHASE I INSPECTION REPORT

NATIONAL DAM SAFETY PROGRAM

DEPARTMENT OF THE ARMY
PHILADELPHIA DISTRICT, CORPS OF ENGINEERS
PHILADELPHIA, PENNSYLVANIA 19106

MARCH 1980

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

Name: Darlington Lake Dam, I.D. NJ 00230
State Located: New Jersey
County Located: Bergen County
Stream: Darlington Brook
River Basin: Passaic River
Date of Inspection: November 13 and December 3, 1979

Assessment of General Conditions

Darlington Lake Dam is an earthfill dam with a concrete drop inlet, the main spillway, at the left end of the dam. In addition, there is an auxiliary spillway along the left shoreline. The overall condition of the dam is good. There are no signs of distress or instability in the embankment. Minor seepage was observed at the parking area opposite the low-level outlet and at the base of the auxiliary spillway. The downstream channel is well defined and in good condition. The low-level outlet is in operable condition. The hazard potential is recommended to be downgraded to "significant".

The spillway capacity of Darlington Lake Dam is not considered questionable in view of the ability of the spillway to pass the SDF (100-year storm) without overtopping the dam.

At present, the engineering data available is not sufficient to make a definitive statement on the stability of the dam, but based on the findings of the visual inspection the preliminary assessment of static stability is that it is satisfactory. The following actions, are recommended along with a timetable for their completion. All recommended actions should be conducted under the supervision of an Engineer who is experienced in the design, construction and inspection of dams.

1. The flow of seepage should be monitored monthly to determine its volume and whether it presents a problem to the safety of the dam.
2. The owner should develop an emergency action plan (if one is not already available) outlining actions to be taken by the operator to minimize downstream effects of an emergency and establish a flood warning system for the downstream communities within three months.

Furthermore, while of a less urgent nature, the following additional action is recommended and should be carried out within twenty-four months:

1. The owner should develop within one (1) year after formal approval of the report, written operating procedures and a periodic maintenance plan to insure the safety of the dam.

A handwritten signature in cursive script, reading "John P. Talerico".

John P. Talerico, P.E.
HARRIS-ECI ASSOCIATES

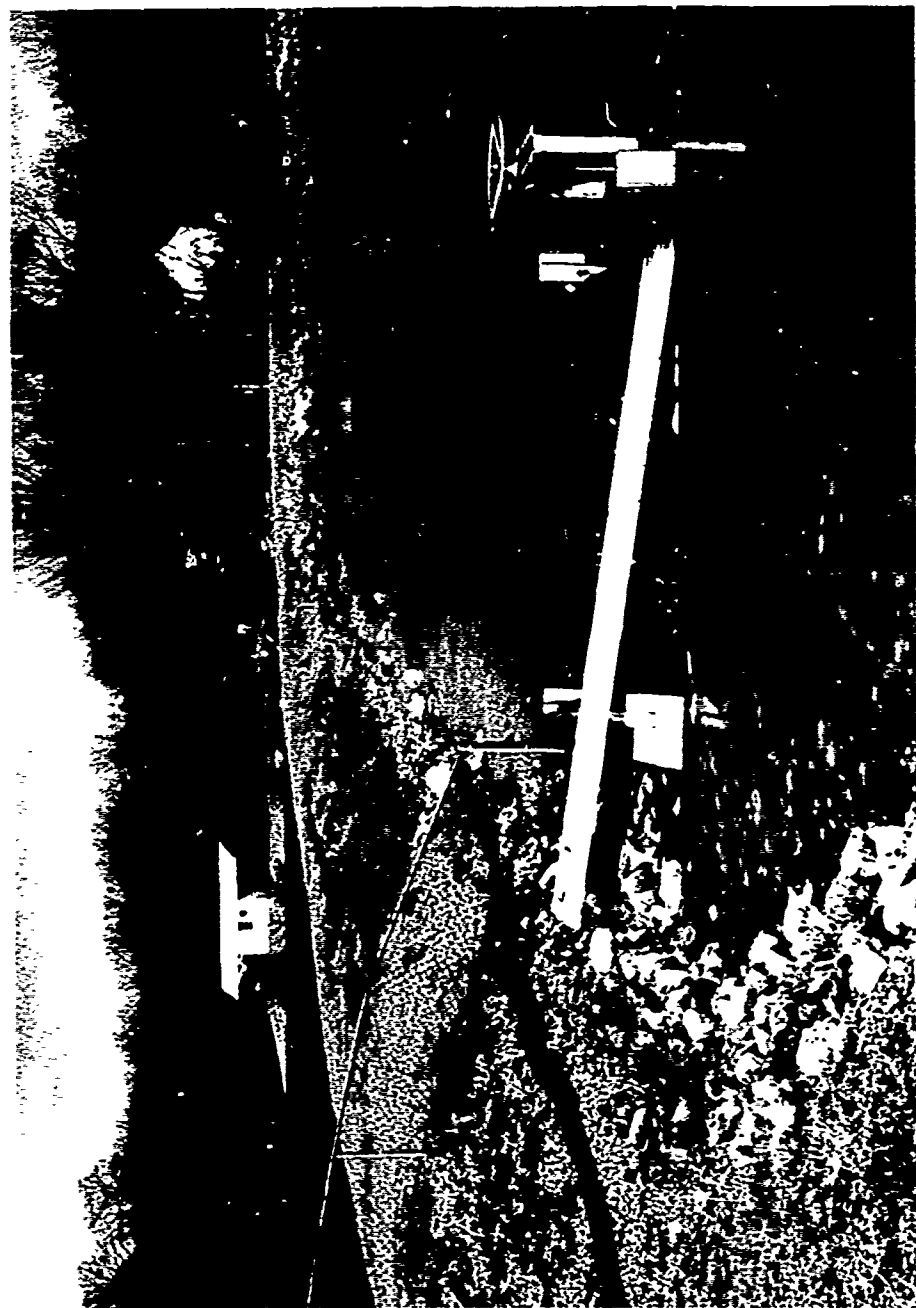


Photo taken on February 8, 1980

BARTLEIGH LAKE DAM

View looking toward right edge of the lake known as the Boating Lake. Embankment is shown at left in photo and portion of lake at right. The main spillway, a drop inlet with a sluice gate, is visible at lower right. A portion of the Parking Area, upper left, is at downstream toe of the embankment.

PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the office of the Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I Investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection can there be any chance that unsafe conditions be detected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the Spillway Test flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. The test flood provides a measure of relative spillway capacity and serves as an aide in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

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PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM
DARLINGTON LAKE DAM, I.D. NJ 00230

SECTION 1

1. PROJECT INFORMATION

1.1 General

a. Authority

The National Dam Inspection Act (Public Law 92-367, 1972), provides for the National Inventory and Inspection Program by the U.S. Army Corps of Engineers. This inspection was made in accordance with this authority under Contract C-FPM No. 35 with the State of New Jersey who, in turn, is contracted to the Philadelphia District of the Corps of Engineers, and was carried out by the engineering firm of Harris-ECI Associates of Woodbridge, New Jersey.

b. Purpose of Inspection

The visual inspection of Darlington Lake Dam was made on November 13, 1979. The purpose of the inspection was to make a general assessment as to the structural integrity and operational adequacy of the dam embankment and its appurtenant structures.

c. Scope of Report

The report summarizes available pertinent data relating to the project; presents a summary of visual observations made during the field inspection; presents an evaluation of hydrologic and hydraulic conditions at the site; presents an evaluation as to the structural adequacy of the various project features; and assesses the general condition of the dam with respect to safety.

1.2 Description of the Project

a. Description of Dam and Appurtenances

Darlington Lake Dam contains the water of the Boating Lake, which is the largest lake and one of three, in the Darlington Lakes complex. The other two lakes are called the Lower Swimming Lake and the Upper Swimming Lake. See Plate 3. Darlington Lake Dam, the Boating Lake, is an earthfill dam approximately 470 feet long and 19 feet high. The embankment has a clay corewall the entire length of the dam plus a concrete corewall approximately 250 feet long at the left end of the dam.

There are two spillways; one is a 10 foot x 10 foot concrete drop inlet, with an aluminum grating (called the main spillway) and the other is a 134 foot long concrete broad crested weir, called the auxiliary spillway. The main spillway is located at the left end of the dam and its crest is 4.5 feet below the top of the embankment. The flow from the spillway discharges into the downstream channel through a 60-inch reinforced concrete pipe which also serves as the low-level outlet. The auxiliary spillway, located along the left shoreline approximately 280 feet left of the main spillway, has a 10 foot notch in the center and discharges directly into the Lower Swimming Lake. The crest of the auxiliary spillway is 2.8 feet above the main spillway.

The embankment has a top width of 9 feet with a 2H:1V slope on both faces. Riprap protection has been placed on the upstream face of the embankment.

The low-level outlet consists of the 60-inch reinforced concrete pipe that carries the discharge of the main spillway. The low-level flow into the pipe is controlled by a 48-inch rising stem sluice gate located on the upstream face of the drop inlet. The gate is raised manually by turning a handwheel attached to the top of the frame.

The outlet end, which is a flared section of pipe, discharges directly into Darlington Brook approximately 95 feet from the downstream embankment toe.

A wooden plank foot bridge, 5 feet wide, spans the auxiliary spillway. The bridge is supported by the spillway's abutment and 17 equally spaced concrete piers. The bridge is 1.7 feet above the spillway.

The downstream channel starts at the discharge from the Lower Swimming Lake and parallels the dam to just past the low-level outlet. There it veers to the left and crosses under the access road to the parking area through a 5 foot by 15 foot opening.

A generalized description of the soil conditions is contained in Report No. 4, Bergen and Hudson Counties, Engineering Soil Survey of New Jersey, by Rutgers University. The report, dated 1952, indicates that Bergen County was subjected to Wisconsin glaciation. Glacial eskers, kames and ground moraine are within the vicinity of Darlington Lake. The lake area proper was formerly an island of ground moraine surrounded by swamp. All spillways appear to be founded on the ground moraine. Ground moraine can be described as unstratified, heterogenous materials, including clay, silt and sand sizes, with varying amounts of gravel, cobbles and boulders. The depth to bed rock in these deposits is usually greater than 20 feet. Bedrock is shown on Geologic Overlay Sheet 23 as Brunswick formation of shale and interbedded sandstone.

b. Location

Darlington Lake Dam is located in Darlington County Park on Darlington Brook, in the Township of Mahwah, Bergen County, New Jersey. It is accessible by way of Darlington Avenue, a main through roadway.

c. Size Classification

According to the "Recommended Guidelines for Safety Inspection of Dams" by the U.S. Department of the Army, Office of the Chief Engineers, the dam is classified in the dam size category as being "small", since its storage volume of 147 acre-feet is less than 1,000 acre-feet. The dam is also classified as "small" because its height of 19.0 feet is less than 40 feet. The overall size classification of Darlington Lake Dam is "small".

d. Hazard Classification

A hazard potential classification of "significant" has been assigned to Darlington Lake Dam. Although there are no residences immediately downstream, the dam is located in a county park resulting in high recreational use of the area. In addition, there is a parking area directly downstream of the dam. Therefore the possibility exists of the loss of a few lives in the event of dam failure.

e. Ownership

Darlington Lake Dam is owned by:

Bergen County Park Commission
327 Ridgewood Avenue
Paramus, NJ 07652

Attention: Mr. James A. McFoul
Executive Director
(201) 646-2680

f. Purpose

Darlington Lake Dam is presently used for recreational purposes only.

g. Design and Construction History

Darlington Lake was constructed in 1951. The original design called for the construction of a concrete corewall except where the fill was to be placed on the existing high ground. During construction, the concrete corewall was only built to a length of 250 ft.-between station 0+50 to station 2+00, as shown on the original plans, with a clay corewall being provided along the remainder of the dam. In addition, clay fill was placed on both sides of the concrete corewall from the foundation to the top of the embankment.

Modifications to the dam consist of raising the existing spillway, constructing a wooden foot bridge across it, and constructing a new drop inlet spillway combined with a new low-level outlet. The new spillway and low-level outlet were constructed in 1978, but there is no record of when the original spillway was modified.

h. Normal Operating Procedures

The discharge from the lake is unregulated and is allowed to naturally balance the inflow into the lake. The low-level outlet is used to lower the lake level as required.

1.3 Pertinent Data

a. Drainage Area 2.25 sq. mi.

b. Discharge at Dam Site

Ungated spillway capacity at elevation of top of dam: 1073 cfs (324.5 NGVD)

Total spillway capacity at maximum pool elevation (SDF): 288 cfs (322.14 NGVD)

c. Elevation (Feet above NGVD)

Top of dam: 324.50

Maximum pool design surcharge (SDF): 322.14

Recreation pool: 320.3

Spillway crest: Main 320.0
Auxiliary 322.4

Streambed at centerline of dam: 306 (estimated)

Maximum tailwater: 309.2 (estimated)

d. Reservoir

Length of maximum pool: 1750 ft. (estimated)

Length of recreation pool: 1700 ft. (estimated)

e. Storage (acre-feet)

Spillway crest: 66 (320.0 NGVD)

Recreational pool: 77

Top of dam: 236

Maximum pool (SDF): 147

f. Reservoir Surface (acres)

Top of dam: 54 (estimated)

Maximum pool (SDF): 41.1 (estimated)

Recreation pool: 26 (estimated)

Spillway crest: 23 (320.0 NGVD)

g. Dam

Type:	Earthfill with concrete drop inlet
Length:	470 ft. (effective)
Height:	19 ft.
Top width:	9 ft.
Side slopes - Upstream:	2H:1V
- Downstream:	2H:1V
Zoning:	Unknown
Impervious core:	470 ft clay core 250 ft. concrete core
Cutoff:	None
Grout curtain:	None

h. Diversion and Regulating Tunnel

N/A

i. Spillway

Type:	Main	Concrete Drop Inlet
	Auxiliary	Concrete Broad Crested Weir
Length of weir:	Main	30.4 ft.
	Auxiliary	134 ft.
Crest elevation:	Main	320.0 (NGVD)
	Auxiliary	322.8 (NGVD)
Gates:		None
U/S Channel:		Darlington Lake
D/S Channel:	Main	Natural Channel
	Auxiliary	Lower Swimming Lake

j. Regulating Outlets

Low level outlet:	60-inch R.C.P.
Controls:	Manually controlled 48-inch sluice gate
Emergency gate:	None
Outlet:	306.8 NGVD

SECTION 2

2. ENGINEERING DATA

2.1 Design

Drawings for the original construction of Darlington Lake Dam are available in the files of N.J. Department of Environmental Protection (NJ-DEP), in Trenton. The drawings for the drop inlet spillway and new low-level outlet are available in the files of the Bergen County Park Commission in Paramus, N.J. No data from soil borings, soil tests, design computations, or other geotechnical data is available to assess the stability properly. Data concerning the hydraulic capacity of the main spillway or the modified auxiliary spillway is also unavailable.

2.2 Construction

Data is not available concerning the as-built construction of the dam. One inspection report during the construction is on file at the NJ-DEP. No data exists of construction methods, borrow sources or other data pertinent to the construction of the dam.

2.3 Operation

Formal operation records are not kept for the dam and reservoir. The lake is allowed to operate naturally without regulation.

2.4 Evaluation

a. Availability

The availability of engineering data is fair. The construction plans for the dam are available from the NJ-DEP, and the Bergen County Park Commission.

b. Adequacy

The engineering data available from the plans and from the field was adequate to perform hydrologic and hydraulic computations. The data was insufficient to perform stability analysis, but a preliminary evaluation could be made based on visual observations.

c. Validity

The information contained in the drawings and checked by limited field measurements appears to be valid, except for the height of the auxiliary spillway and the width of the embankment crest. The original construction plans do not show the modifications to the spillway, and also show the width of the embankment crest to be 20 feet instead of the present 9 feet.

SECTION 3

3. VISUAL INSPECTION

3.1 Findings

a. General

Darlington Lake Dam contains the water of the Boating Lake, which is the largest lake and one of three in the Darlington Lakes system. The other two lakes are called the Lower Swimming Lake and the Upper Swimming Lake. Of the three lakes the Boating Lake's embankment and its two spillways have the major influence on downstream conditions.

The visual inspection of the Boating Lake Dam, henceforth called Darlington Lake Dam, revealed the dam and its spillway to be in good condition. At the time of the inspection the lake's water level was above the crest of the main spillway.

b. Dam

The earth embankment appears to be sound. No surface cracking on the embankment or at the toe was noted. No sloughing or erosion of the embankment was observed. The vertical and horizontal alignment of the crest was good. Grass, freshly trimmed, was growing on the embankment. No trees or vegetation were growing on the embankment. Minor seepage was visible on the parking area pavement, downstream side of the embankment, opposite the main spillway. No evidence of burrowing by animals was observed.

c. Appurtenant Structures

1. Spillways

The main spillway is a drop inlet structure with a sluice gate. It was recently constructed and is in excellent condition. The auxiliary spillway is concrete and in good condition. Horizontal and vertical alignment of the auxiliary spillway appeared good. Slight seepage was visible at the base of the auxiliary spillway.

2. Bridge and Piers

Concrete piers, part of the auxiliary spillway, support a wooden plank bridge across the auxiliary spillway. The bridge and piers are in good condition.

3. Outlet Works

The low-level outlet works is also the main spillway. It consists of a drop inlet with a 48-inch rising stem sluice gate, operated by a handwheel attached to the top of the frame, at the upstream face of the drop inlet and a 60-inch diameter reinforced concrete pipe that carries the flow from the drop inlet directly downstream into Darlington Brook. The outlet works was recently constructed and is in excellent condition. There is no headwall at the end of the 60-inch R.C.P. - at Darlington Brook.

a. Reservoir Area

The reservoir's side slopes are flat to moderate. There is not indication of slope instability. The reservoir was clear with no growth of algae.

e. Downstream Channel

The downstream channel is in good condition. Its side slopes are mostly 2H:1V and wooded. The channel flows under an access road approximately 50 feet from where the 60-inch reinforced concrete pipe (low-level outlet) discharges into Darlington Brook. The access road is near the Parking Area within the Park grounds.

The Parking Area is at the toe of the downstream side of the embankment. Approximately one half mile downstream from the embankment, on Darlington Avenue, there are four houses located on the channel's left bank. These houses are located out of the flood plain.

SECTION 4

4. OPERATIONAL PROCEDURES

4.1 Procedures

Darlington Lake Dam is used to impound water for recreational activities. The level of the lake is maintained through the unregulated flow over the main spillway.

4.2 Maintenance of the Dam

There is no regular inspection and maintenance program for the dam and appurtenant structures. The Bergen County Park Commission is responsible for the maintenance of the dam.

4.3 Maintenance of Operating Facilities

The low-level outlet operating facilities consist of one manually operated 48-inch sluice gate. At the time of the inspection, the operation of the gate was satisfactorily shown.

4.4 Evaluation

The present operational and maintenance procedures are fair with the dam and spillway being maintained in a serviceable condition.

SECTION 5

5. HYDRAULIC/HYDROLOGIC

5.1 Evaluation of Features

a. Design

The drainage area above Darlington Lake Dam is approximately 2.25 square miles. A drainage map of the watershed of Darlington Lake dam site is presented on Plate 1, Appendix D.

The topography within the basin is generally mildly sloped. Elevations range from approximately 470 feet above NGVD at the west end of the watershed to about 325 feet at the dam site. Land use patterns within the watershed are mostly woodland.

The evaluation of the hydraulic and hydrologic features of the Darlington Lake Dam was based on criteria set forth in the Corps Guidelines and additional guidance provided by the Philadelphia District, Corps of Engineers. The SDF for the dam falls in a range of 100-year Flood to 1/2 PMF. In this case, the low end of the range, 100-year Flood, is chosen since the factors used to select size and hazard classification are on the low-side of their respective ranges.

The 100-year Flood was calculated by using the New Jersey Special Report No. 38. The SDF peak discharge for the dam is 288 cfs and does not result in overtopping the dam.

The reservoir surface areas at various elevations were measured by planimeter from U.S.G.S. Quadrangle topographic map. The spillway rating curve was based on the assumption that the dam remains intact during routing. The spillway rating curve is presented in the Hydrologic Computations, Appendix D.

Drawdown calculations indicate that to empty the lake to an elevation of 309.2 NGVD through the one low-level sluice would take 4.2 hours, assuming a 2 cfs/sq. mi. inflow.

b. Experience Data

No records of reservoir stage or spillway discharge are maintained for this site.

c. Visual Observation

The downstream channel is well defined and in good condition. The slopes of the channel are mostly 2H. to 1V. and steeper.

The side slopes of the reservoir are flat to moderate and do not exhibit signs of instability. The drainage area is wooded and undeveloped.

d. Overtopping Potential

As indicated in Section 5.1 a, the spillway capacity of Darlington Lake Dam is considered to be adequate. There is no overtopping potential at the 100-year flood.

SECTION 6

6. STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability

a. Visual Observations

There are no signs of distress in the embankment of the Darlington Lake Dam. Minor seepage was observed at the Parking Area approximately opposite the low-level outlet. The seepage has not been monitored and no information was uncovered concerning its flow rates.

The drop inlet spillway is new and in excellent condition. At the auxiliary spillway, minor seepage was flowing at its base. This seepage has not been monitored but at the time of inspection, it was planned by the Park's maintenance force to place a clay blanket over the seepage area.

b. Design and Construction Data

No design computations relating to stability were uncovered during the report preparation phase. No embankment or foundation soil parameters are available for carrying out a conventional stability analysis on the embankment.

c. Operating Records

No operating records are available relating to the stability of the dam.

d. Post-Construction Changes

None on record.

e. Static Stability

A static stability analysis was not performed for Darlington Lake Dam because the lack of data on which to base assumptions of material properties within embankment zones might produce misleading results, but based on the findings of the visual inspection, the preliminary assessment of static stability is that it is satisfactory.

f. Seismic Stability

Darlington Lake Dam is located in Seismic Zone 1, as defined in Recommended Guidelines for Safety Inspection of Dams, prepared by the Corps of Engineers. In general, projects located in Seismic Zones 0, 1 and 2 may be assumed to present no hazard from earthquake, provided the static stability condition are satisfactory and conventional safety margins exist, and based on the findings of the visual inspection, the preliminary assessment of the static and seismic stabilities is that they are satisfactory.

SECTION 7

7. ASSESSMENT/REMEDIAL MEASURES

7.1 Dam Assessment

a. Safety

The dam has been inspected visually and a review has been made of the available engineering data. This assessment is subject to the limitations inherent in the visual inspection procedures stipulated by the Corps of Engineers for a Phase I report.

The adequacy of Darlington Lake Dam is not in question because the dam does have adequate spillway capacity to pass the 100-year flood, which is the SDF for the dam, without overtopping.

No definitive statement pertaining to the safety of the embankment can be made without acquisition of embankment and foundation material engineering properties, but based on the findings of the visual inspection, the preliminary assessment of static stability is that it is satisfactory.

b. Adequacy of Information

The information uncovered was adequate to perform hydrologic and hydraulic computations. The data was insufficient to perform even an approximate computation of the stability of the dam. A preliminary assessment of the dam could be made by visual observation only.

c. Urgency

The remedial measures and recommended actions along with a timetable for their completion are detailed below. All recommended actions should be conducted under the supervision of an engineer who is experienced in the design, construction and inspection of dams.

7.2 Remedial Measures

a. Alternatives for Increasing Spillway Capacity

Alternatives for increasing spillway capacity are not necessary as it is adequate to handle the SDF.

b. Recommendations

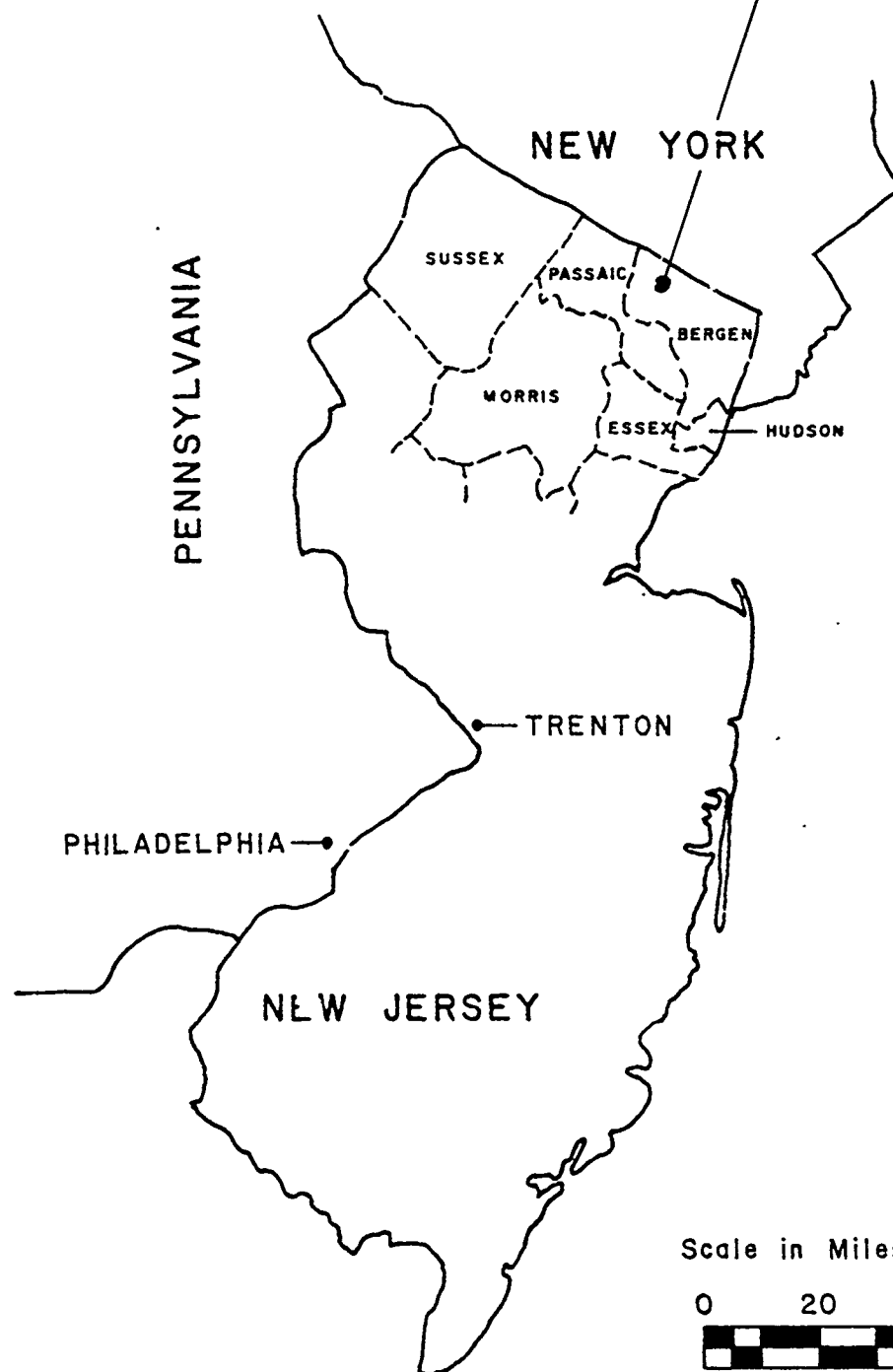
1. The flow of seepage should be monitored monthly to determine its volume and whether it presents a problem to the safety of the dam.
2. The existing dam plans and drawings should be annotated and updated to form a coherent as-built set within twenty-four months.
3. The owner should develop an emergency action plan (if one is not already available) outlining actions to be taken by the operator to minimize downstream effects of an emergency and establish a flood warning system for the downstream communities within three months.

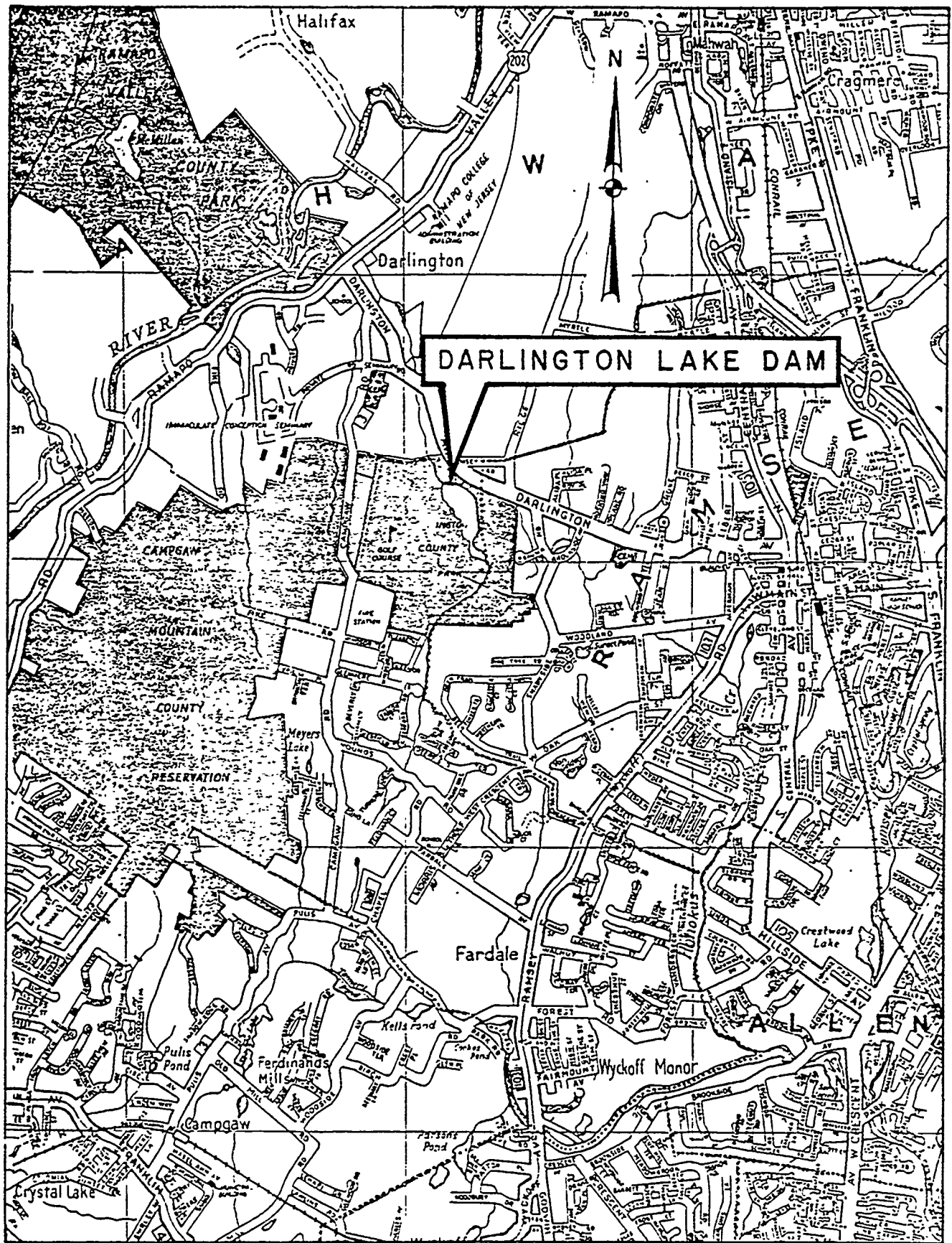
c. O & M Procedures

The owner should develop, within one (1) year after formal approval of the report, written operating procedures and a periodic maintenance plan to insure the safety of the dam.

P L A T E S

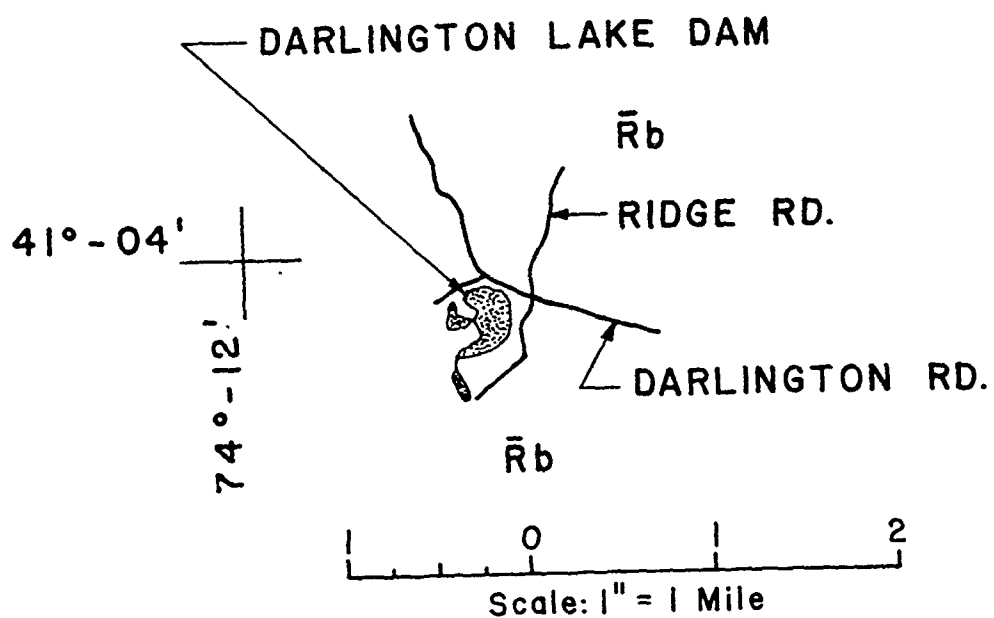
DARLINGTON LAKE DAM
MAHWAH TOWNSHIP
BERGEN COUNTY, N. J.





Scale in Feet (Approx.)

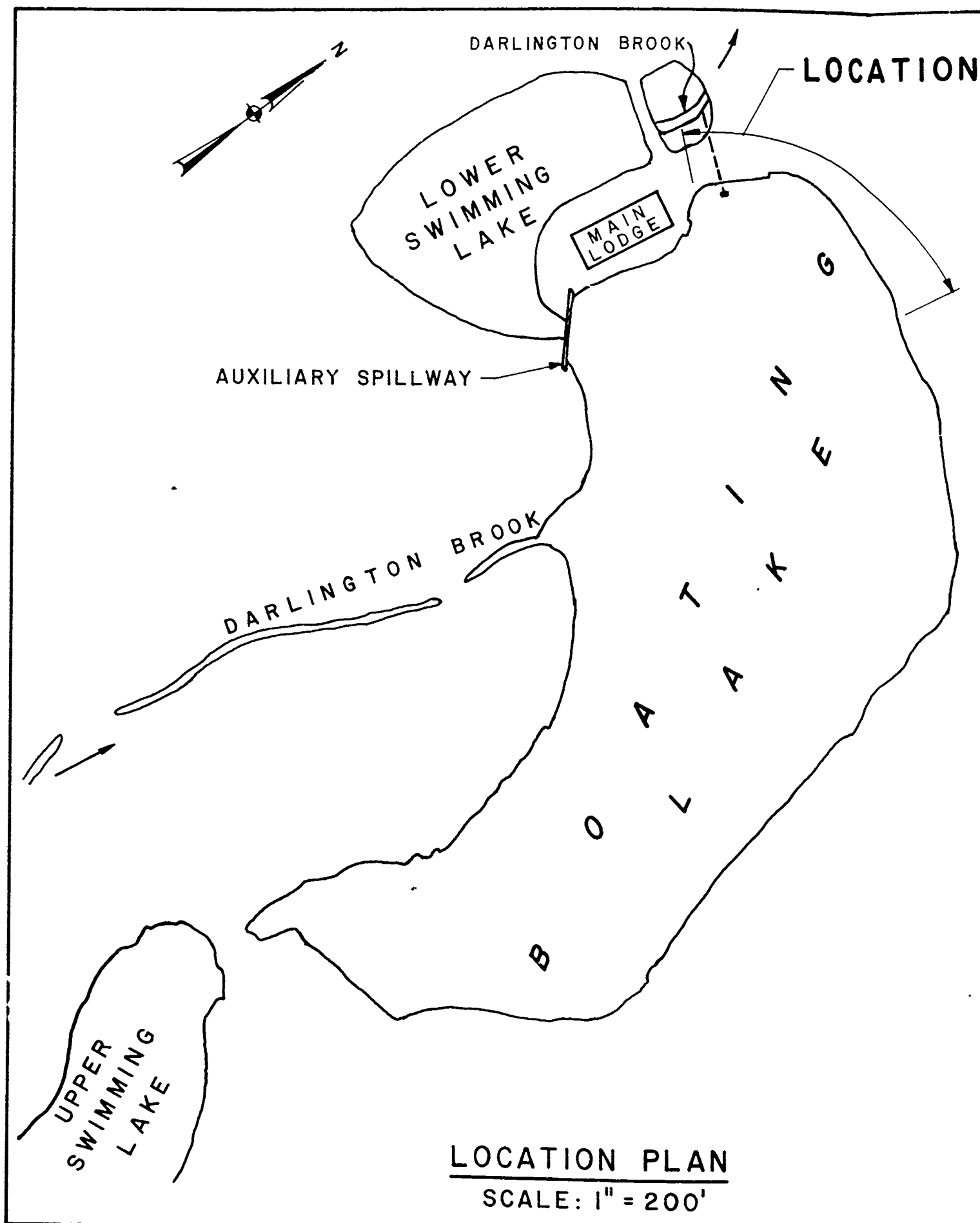
2,000 0 2,000 4,000 6,000 8,000 10,000



LEGEND:

$\bar{R}b$ TRIASSIC
Brunswick Formation

GEOLOGIC MAP
DARLINGTON LAKE DAM



OF DAM

AVE.

DARLINGTON

DARLINGTON BROOK

60'
(LO)

LOWER
SWIMMING
LAKE

MAIN
LODGE

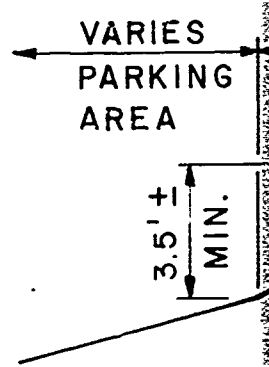
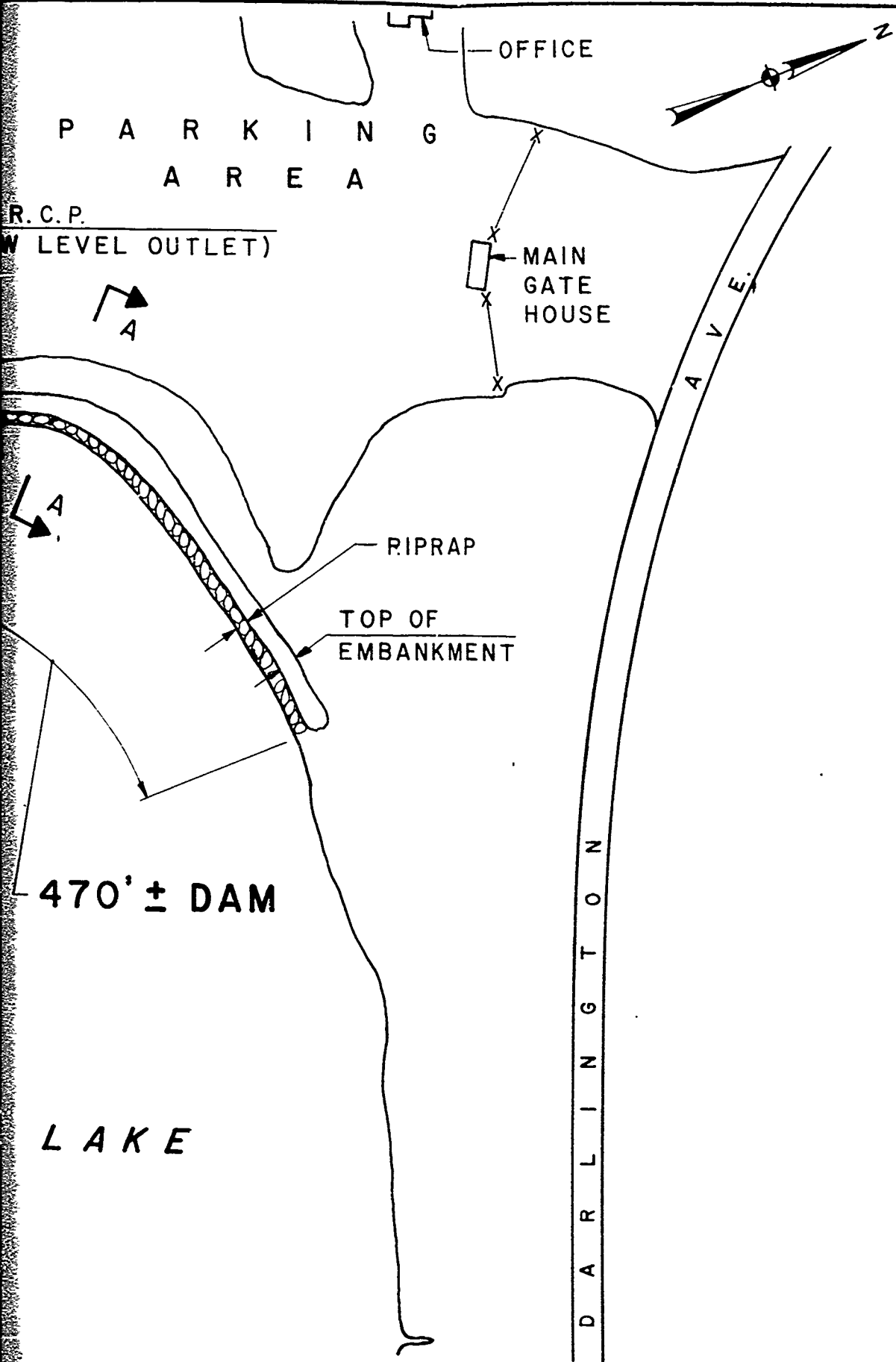
AUXILIARY SPILLWAY
5' WIDE WOODEN PLANK
BRIDGE ON CONCRETE PIERS

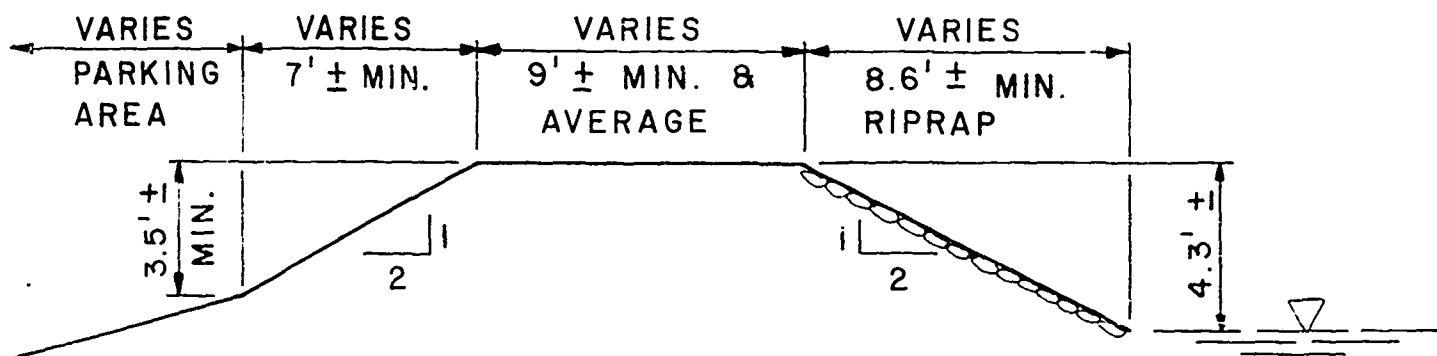
MAIN SPILLWAY
(DROP INLET SHOWN
ON PLATE 5)

BOATING

PLAN

SCALE: 1" = 100'





SECTION A - A
SCALE: 1" = 5'

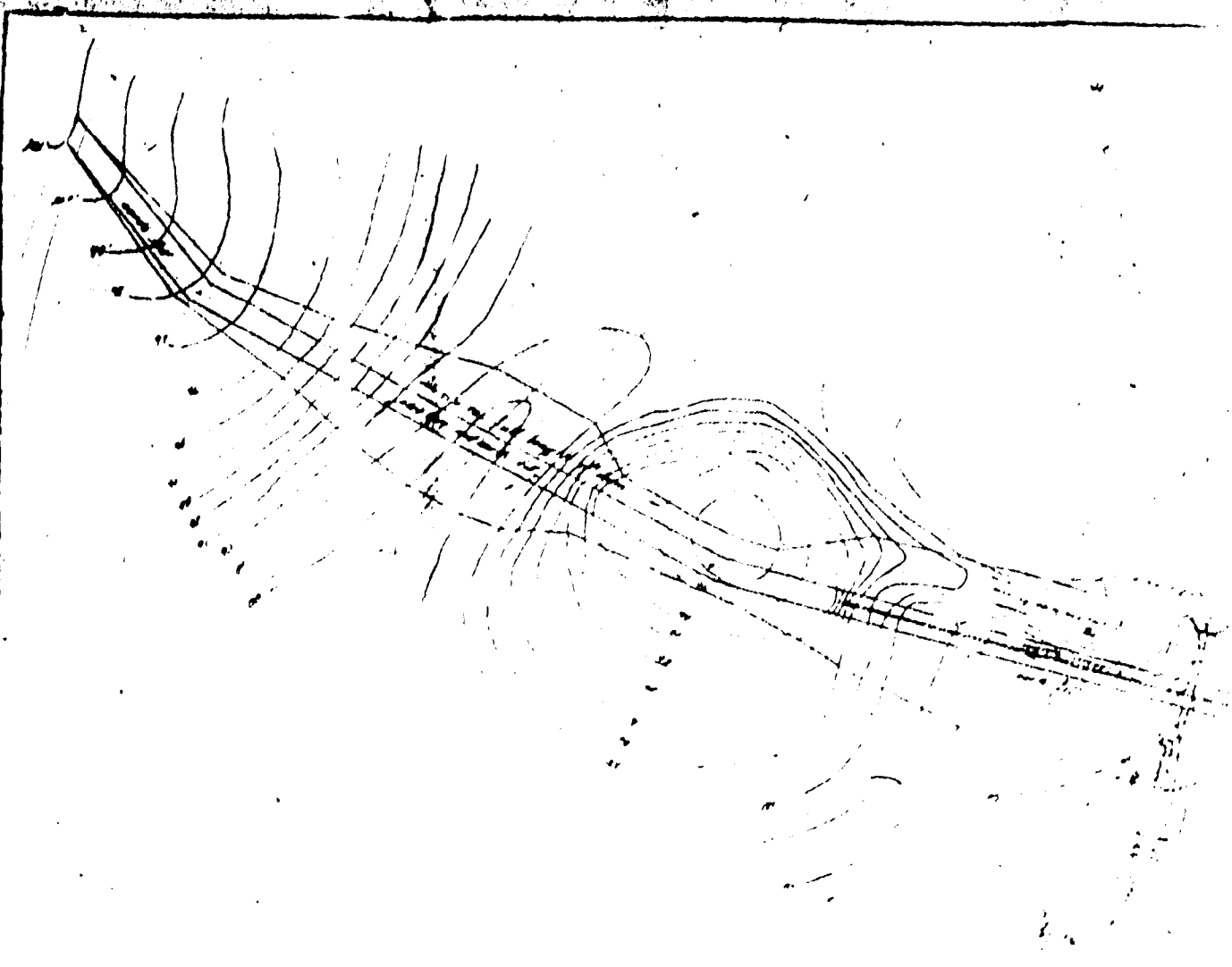
DARLINGTON LAKE DAM
MAHWAH TOWNSHIP, BERGEN COUNTY, N. J.

SKETCHES OF PLANS AND SECTION
PREPARED FROM FIELD NOTES TAKEN
DURING INSPECTION ON NOV. 13, 1979
AND FROM OTHER PLANS & DRAWINGS

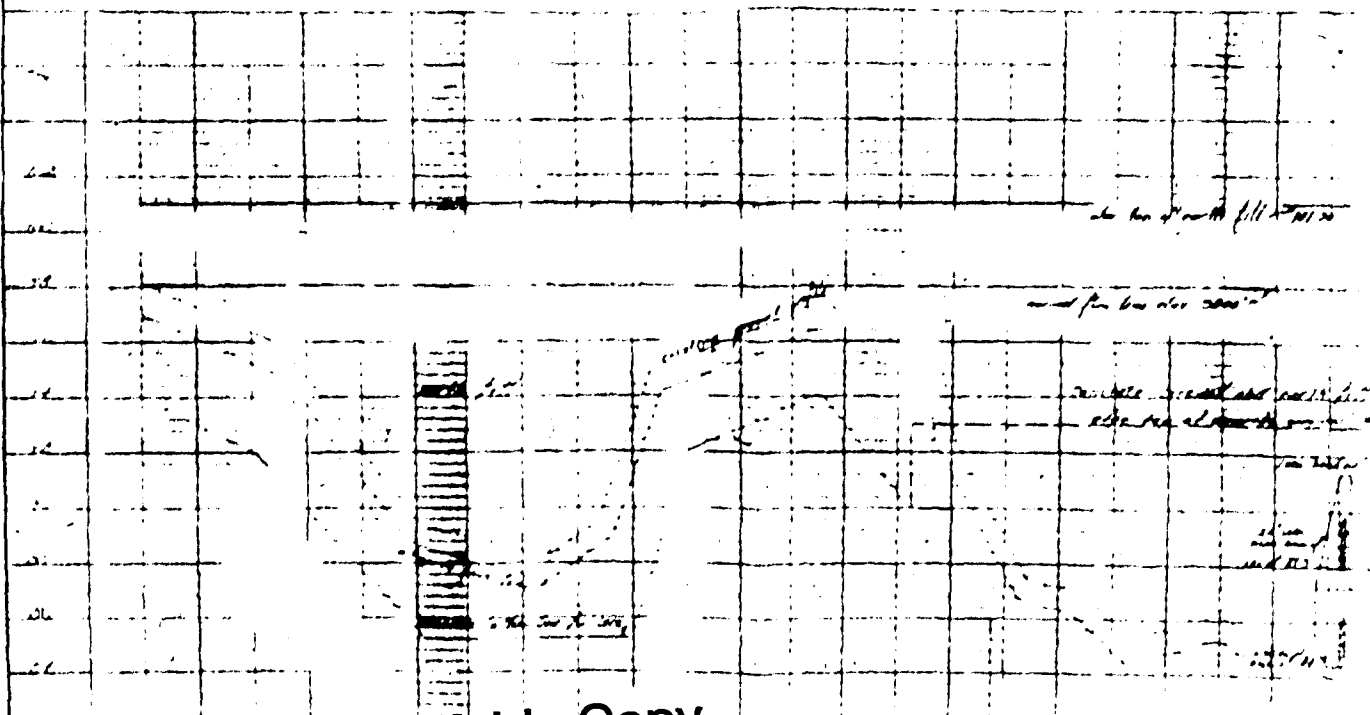
BY:
HARRIS - ECI ASSOCIATES
WOODBIDGE, NEW JERSEY

SCALE: AS SHOWN
DATE: FEB. 28, 1980
SHEET: 1 OF 1

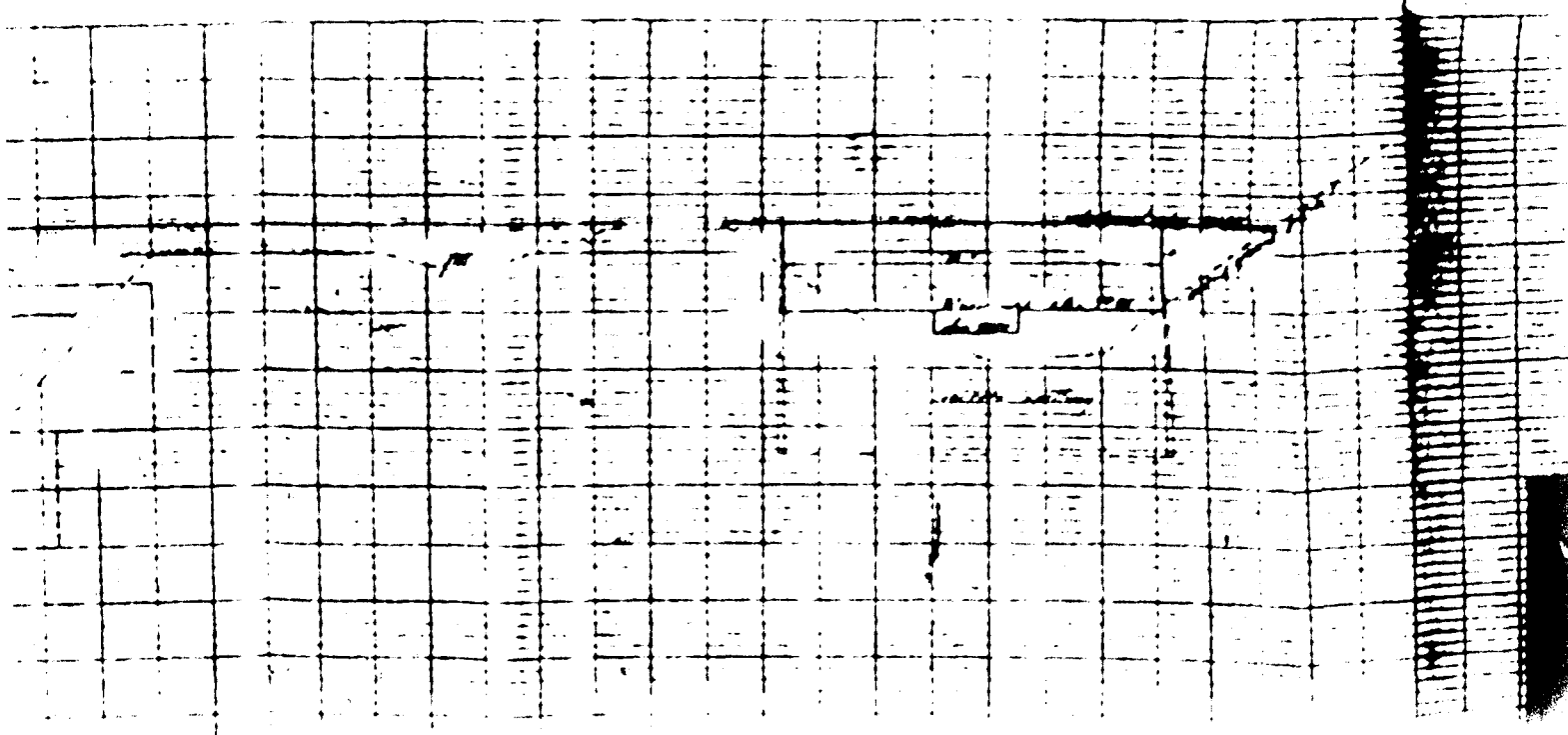
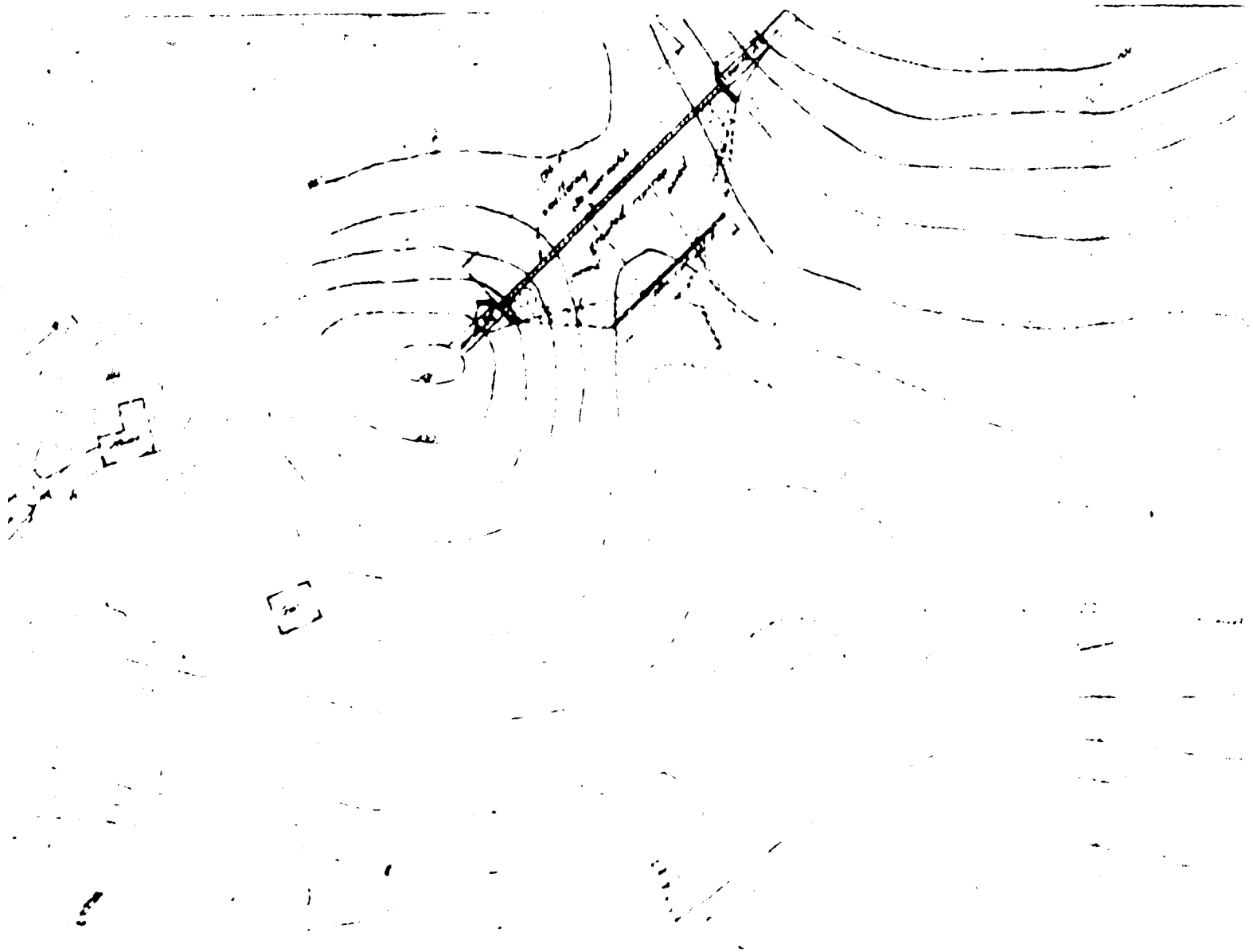
PLAN	UNCLASSIFIED
DATE BOOK	DATE OF COPY
NO.	NO.

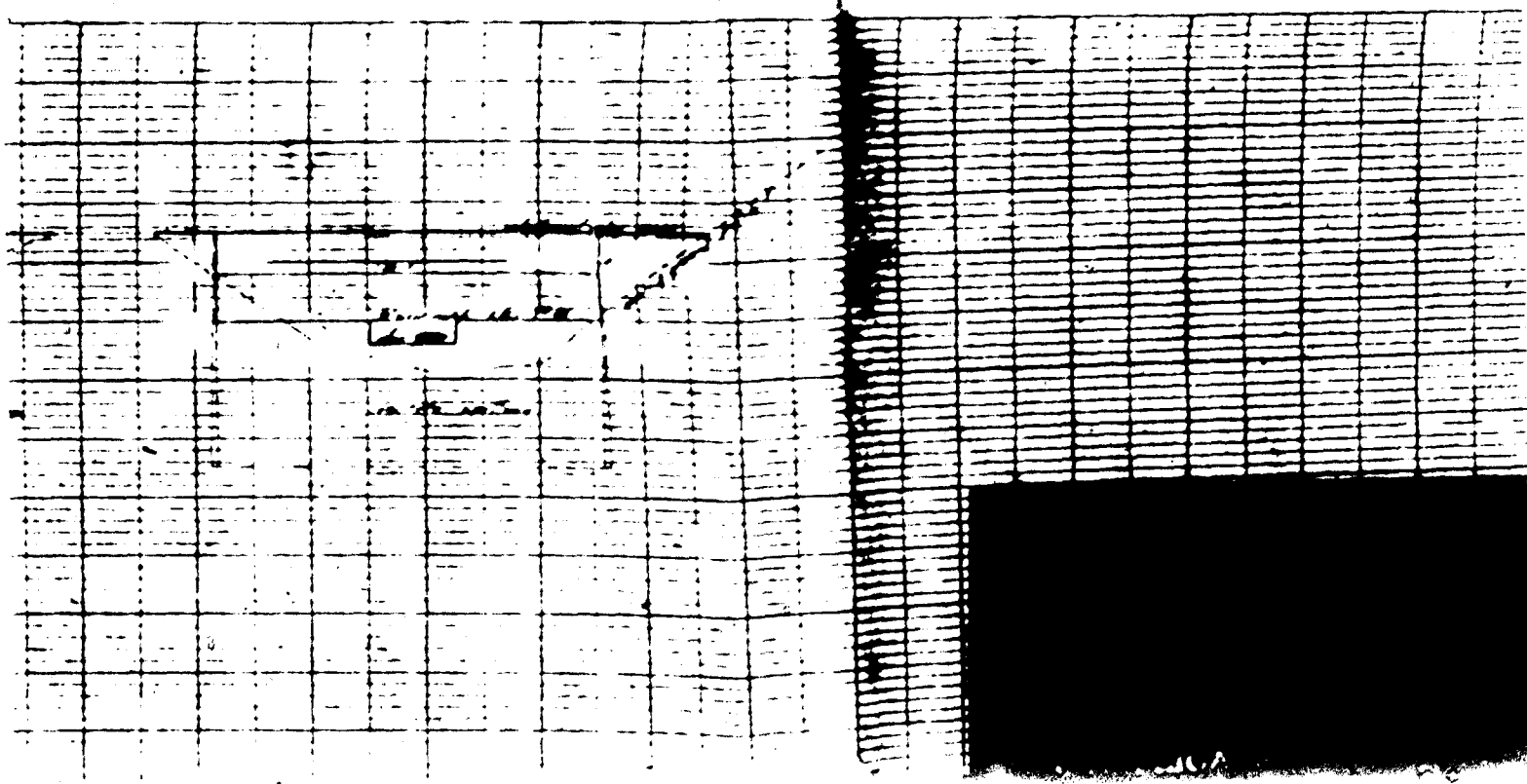
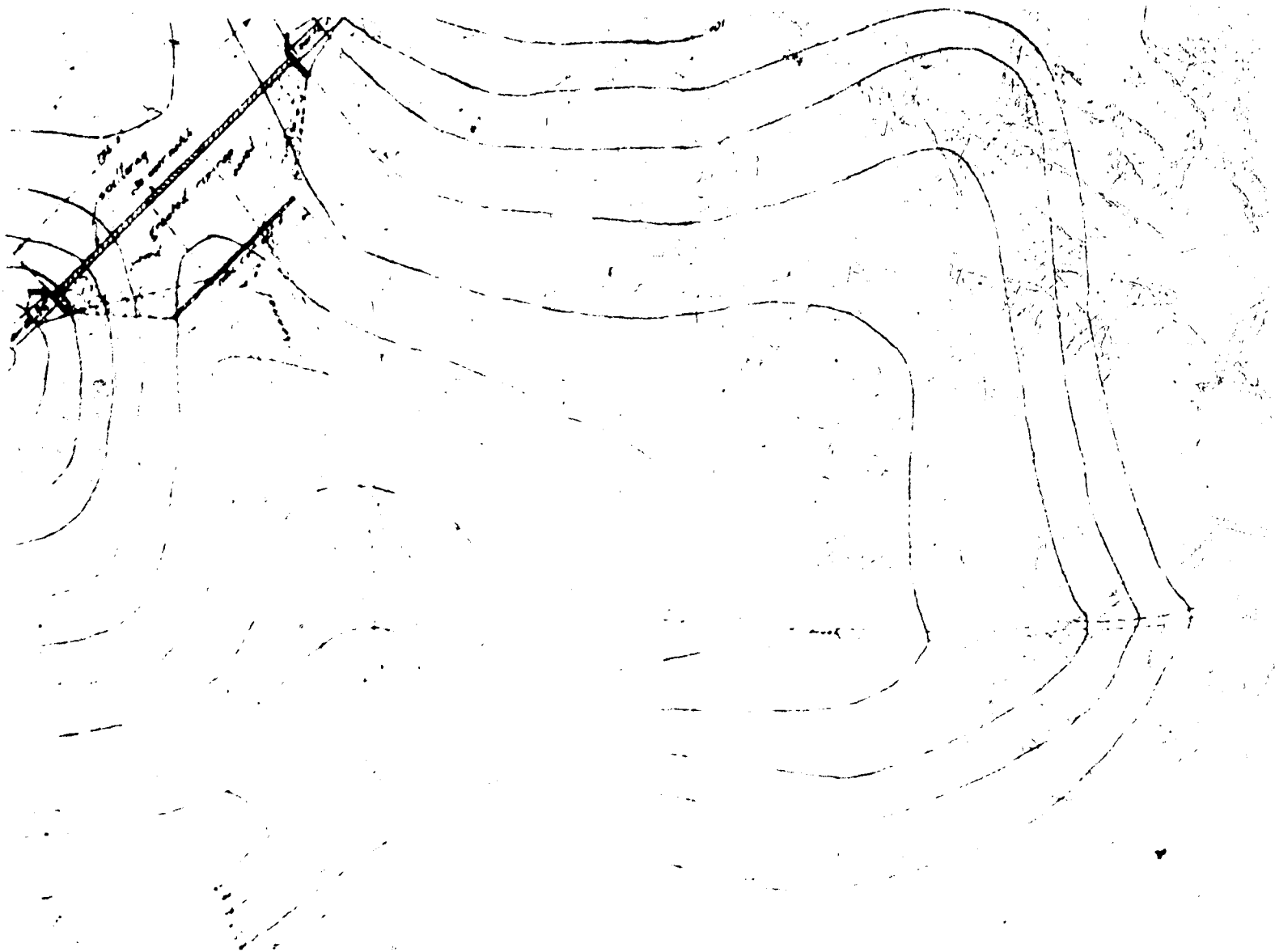


PLAN



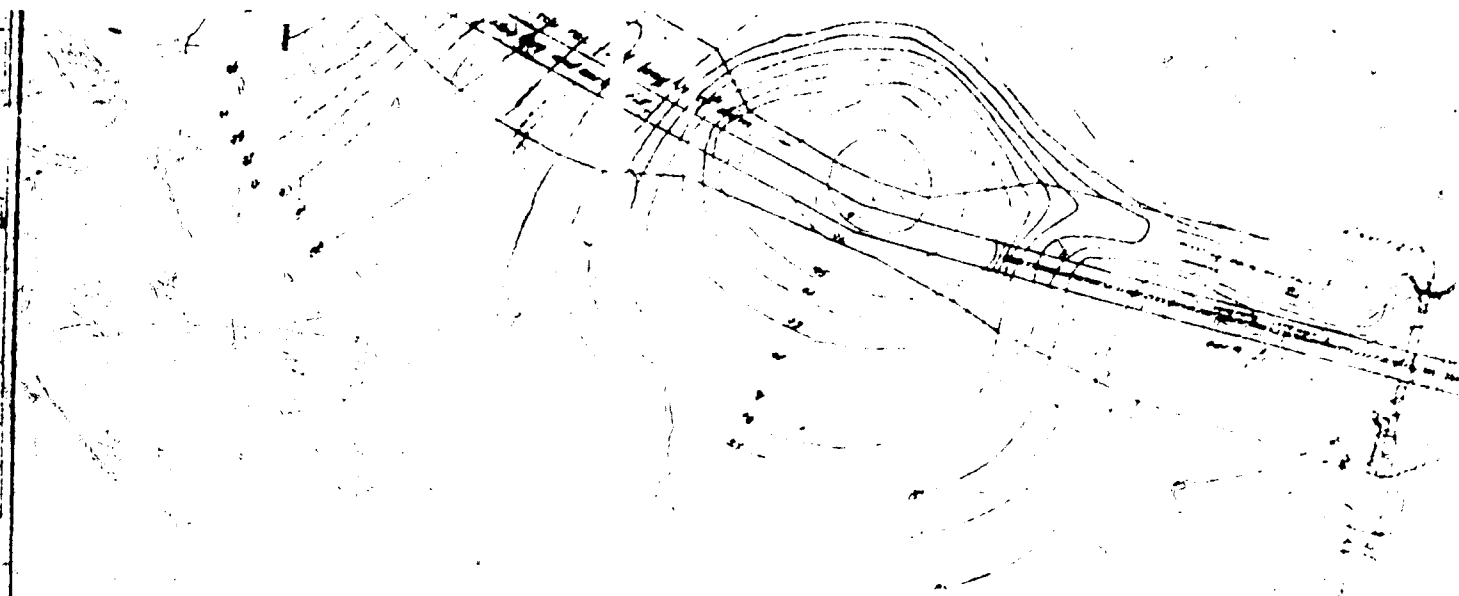
Best Available Copy



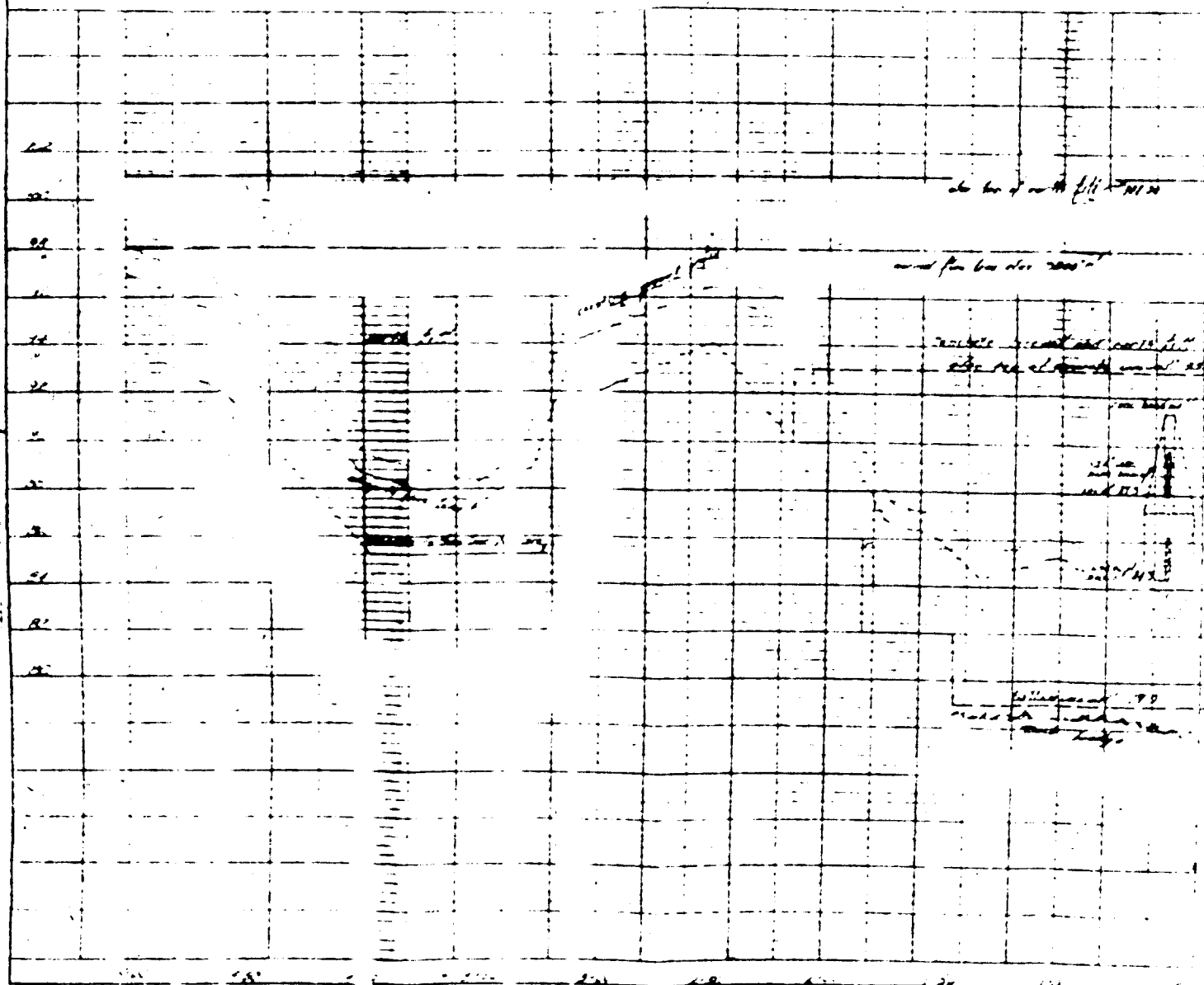


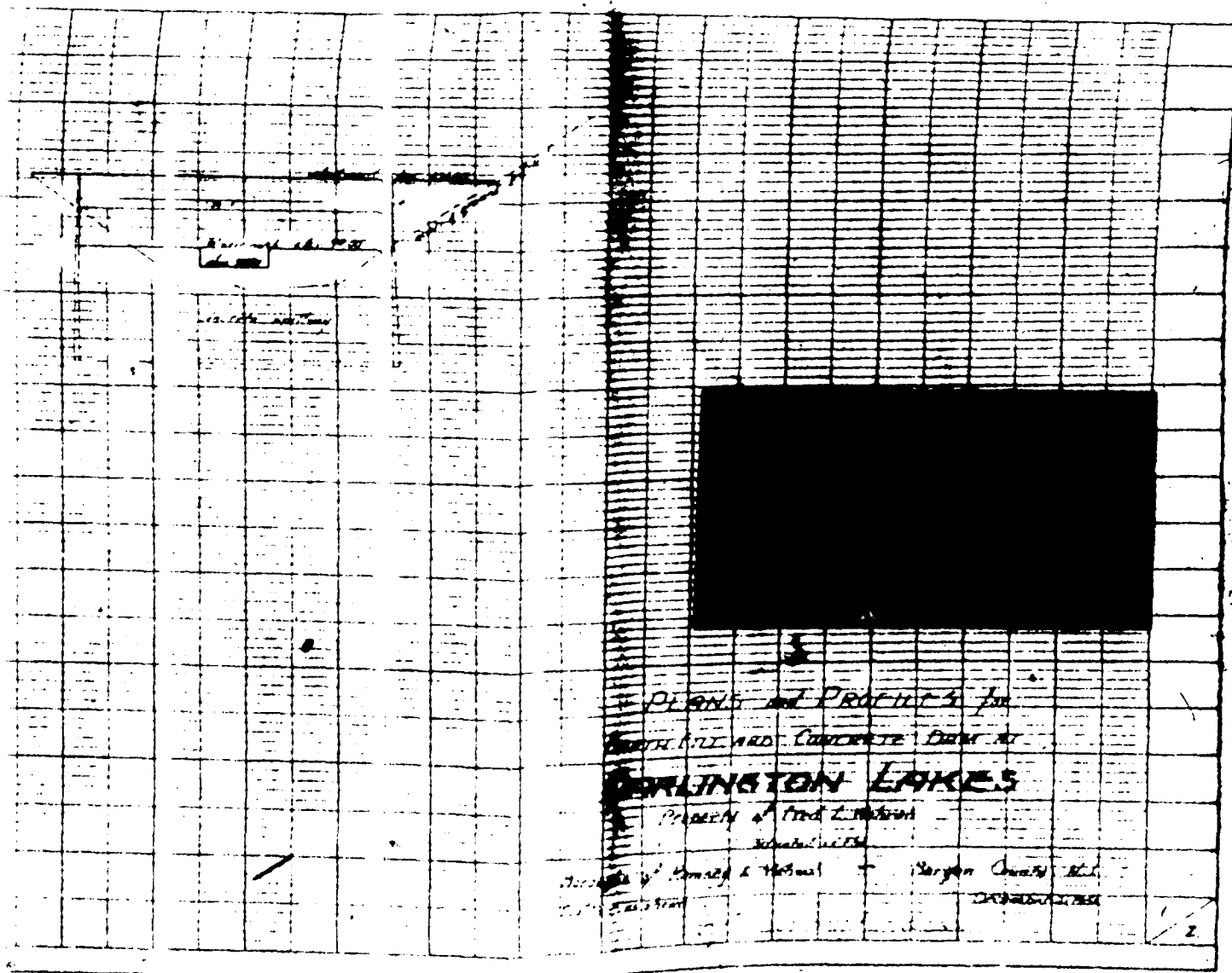
31308

PLAN	UNAVOIDED PATTERNS
MORE MODERN	IMPROVEMENT IN THE BY 11 MAY 1964

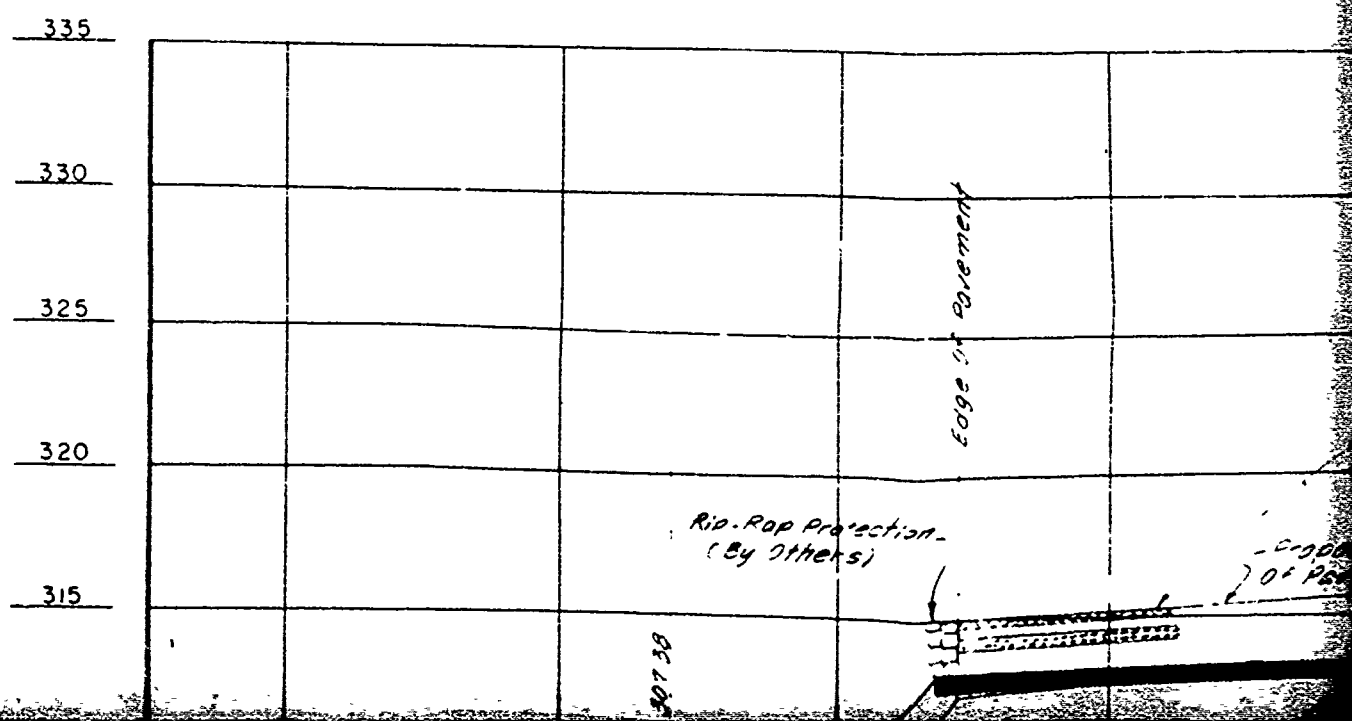
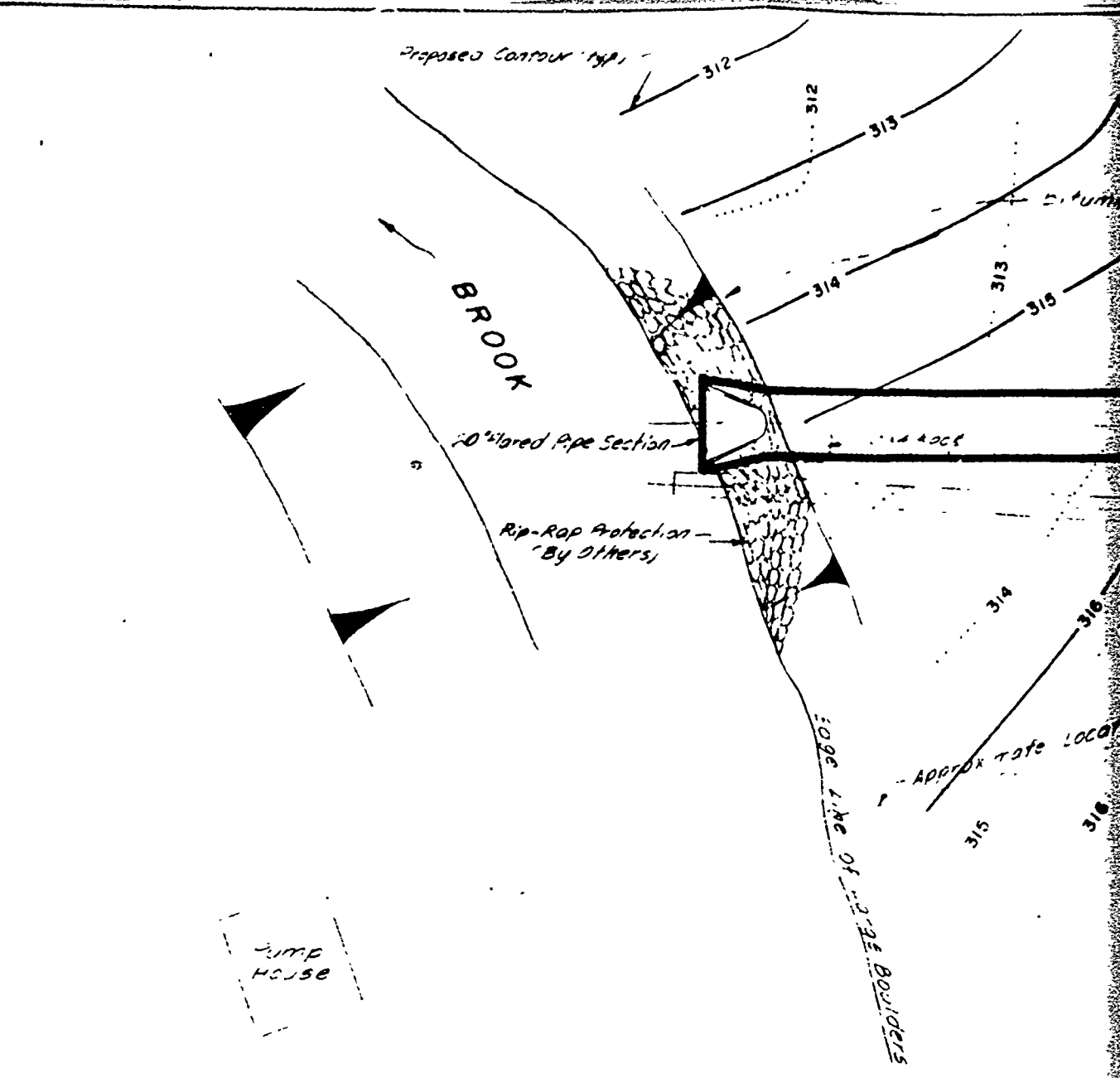


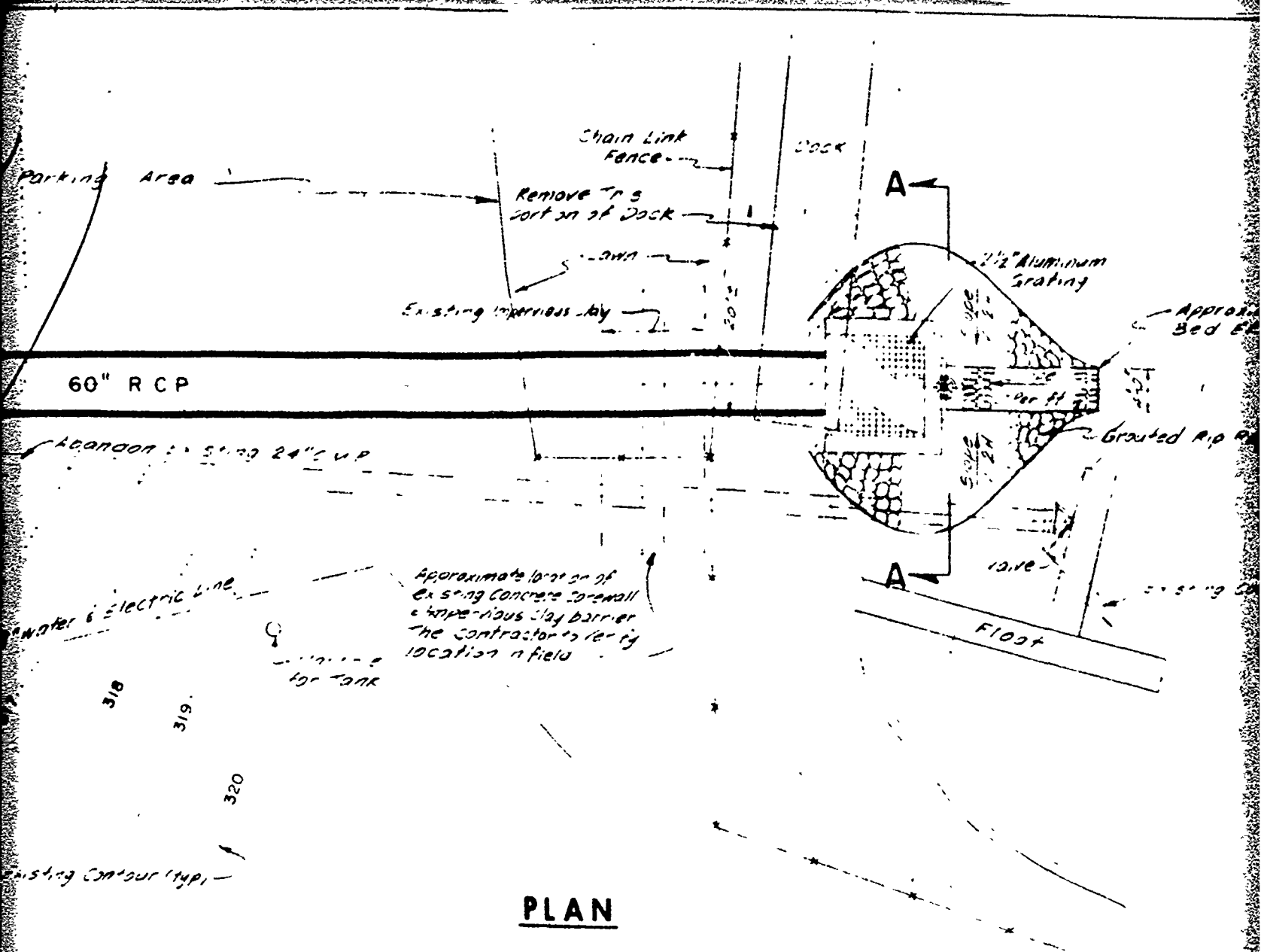
PLAN





450





PLAN

SCALE: 1" = 10'

The contractor shall break through existing concrete seawall and remove of pipe 0.5 ft. Pvc shall be grouted in place using non-shrink grout and sealant applied which shall make joint water-tight.

FASC
Stabilized Base
Subbase

Existing Pavement

Existing Ground

Existing Impervious Clay

Impervious Earth Fill

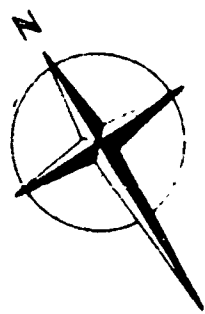
E1 321.00

E1 320.00

Se shall be grouted using non-shrink grout sealant applied which the joint water-tight.

APPROX.

3



Minimum
Rating

Approximate ore
Bed El 311.40

Grouted Rip rap

BOATING LAKE

existing conc. Kern wall

Notes 1. The contractor may be allowed
to over the Lakes Water level
during construction as per
Specifications.

2. Contractor to plug ex spring 24" MP
with concrete after it is approved
such that this pipe is rendered
water-tight See specifications

El 320.39

Spillway El 322.30

shall be grouted in place
with non-shrink grout and
sealant applied which renders
the joint water-tight.

335

330

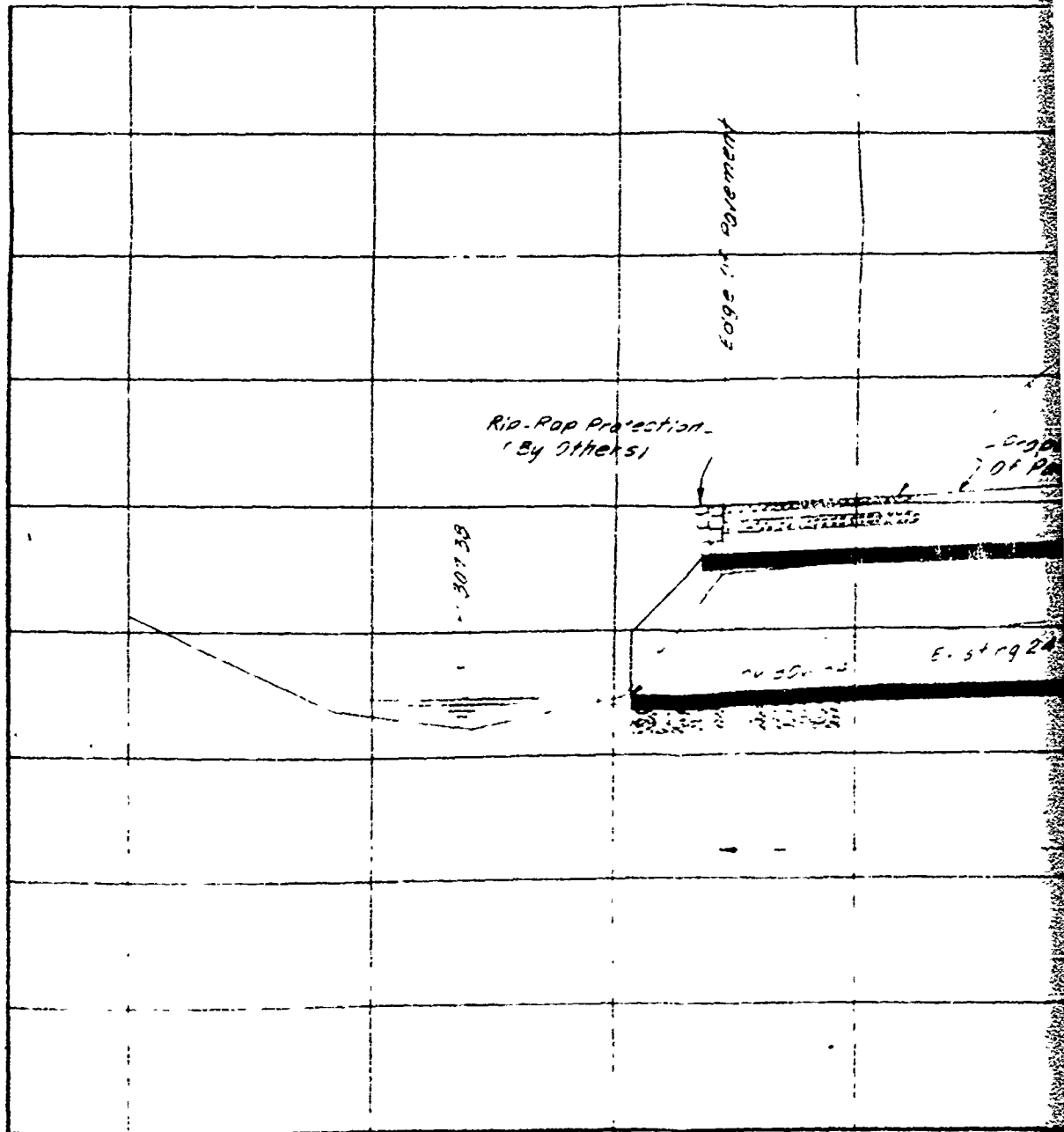
325

320

315

riders

335
330
325
320
315
310
305
300
295
290



PLAN

SCALE: 1" = 10'

Note: The contractor shall break through existing concrete sewer wall 1" x 1" of pipe 0.5 ft. R/W shall be grouted in place using non-shrink grout and sealant applied with 18" x 18" joint water-proofing.

2" FABC
4" B + Stabilized Base
6" Subbase

Existing Pavement

Existing manhole clay

Imperious Earth Fill

Existing Ground

E1 32100 - E1 32000

E1 320.00

ce shall be grouted using non-shrink grout sealant applied with the joint water-proofing.

119 - 60" RCP - 110%

3.950

Slope

Bedrock

Grouted

Earth Backfill

Clay Backfill

Imperious Earth Backfill

Approximate location of existing manhole sewer line and its location relative to the sewer line and its location relative to the sewer line.

PROFILE

SCALES: HOR. 1" = 10'
VERT. 1" = 5'

RECEIVED

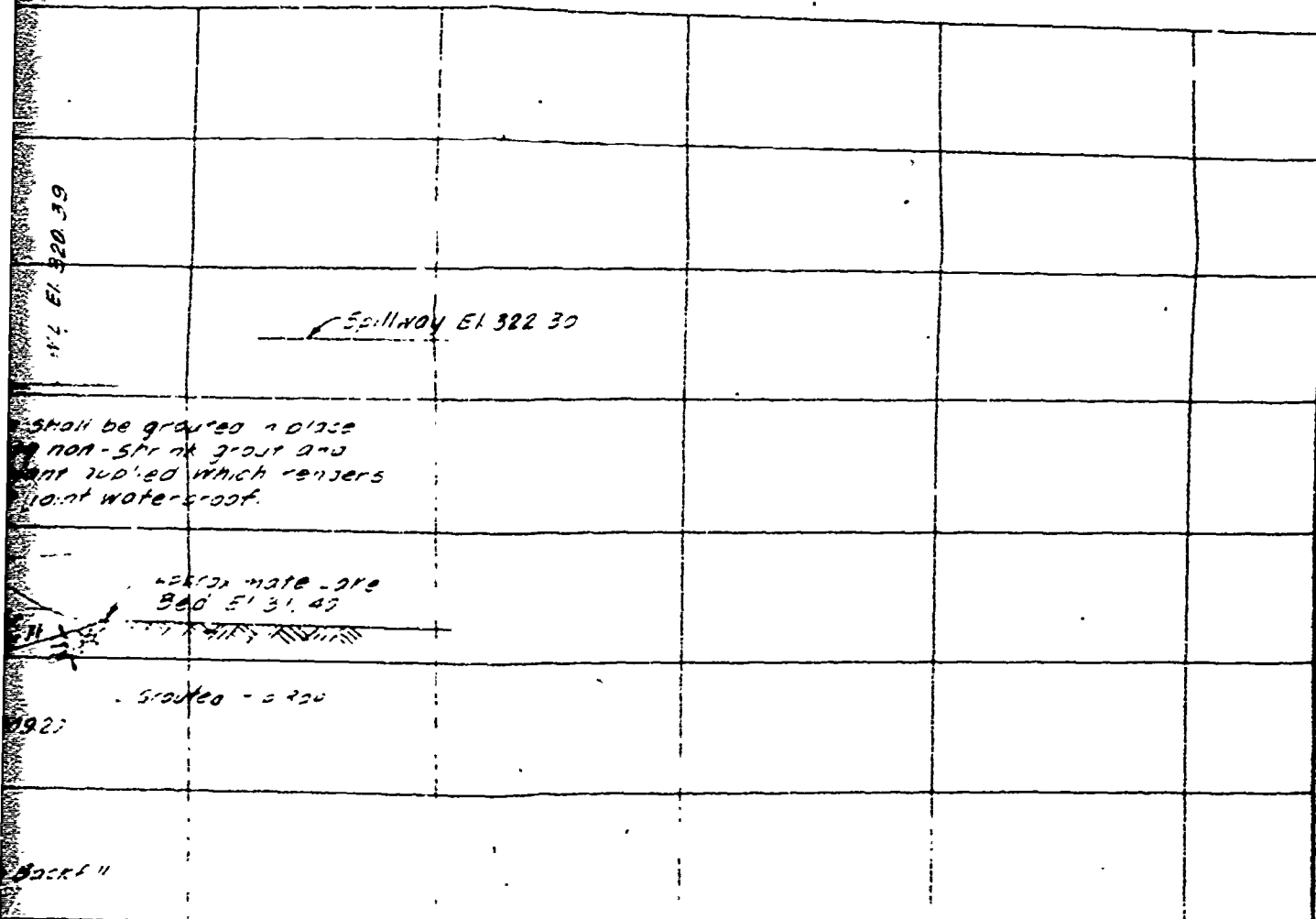
NOV 19 1970

HARRIS, INC.
WOODBRIDGE, N.J.

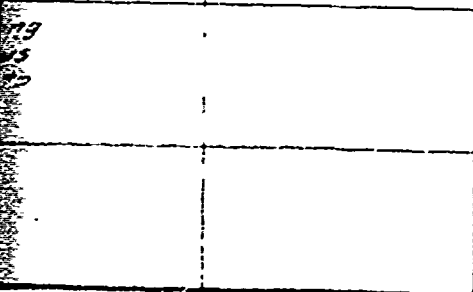
PROFE
GLE

ROY J.
N.J.

PETER
N.J.



335
330
325
320
315
310
305
300



295
290

ELAM AND POPOFF
PROFESSIONAL ASSOCIATION
GLEN ROCK NEW JERSEY

[Signature] 9/8/78
ROY J. ELAM, P.E. DATE
N J LIC NO 11070

PETER D. POPOFF, P.E. DATE
N J LIC NO 11552

REV	DATE	BY	✓	DESCRIPTION

RELIEF OUTLET AT DARLINGTON LAKE
MAHWAH, NEW JERSEY

PLAN & PROFILE

BERGEN COUNTY PARK COMMISSION

DRAWN BY F W Rockwell	CHECKED BY J Jordar
--------------------------	------------------------

APPROVED BY	DATE September, 1978	BOOK
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SCALE As shown	FILE 303	PLAN NO
SHEET 2 of 3	<p>H-32-10399F</p>	

PLATE

APPENDIX A

CHECK LIST - VISUAL OBSERVATIONS

CHECK LIST - ENGINEERING, CONSTRUCTION
MAINTENANCE DATA

CHECK LIST
VISUAL INSPECTION
PHASE 1

Name Dam DARLINGTON LAKE DAM County Bergen State New Jersey Coordinators NJ-DEP

Date(s) Inspection November 13, 1979 Weather Cloudy Temperature 48°F
December 3, 1979

Pool Elevation at Time of Inspection 320 NGVD Tailwater at Time of Inspection 307 NGVD

Inspection Personnel:

November 13, 1979 December 3, 1979
Chuck Chin Eugene Koo
Henry King (Recorder) James McCormick
Thomas Lakovich

Owner/Representative:

November 13, 1979
John Mantineo
Bergen County Park Commission

CONCRETE/MASONRY DAMS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS AND RECOMMENDATIONS
SEEPAGE OR LEAKAGE N/A		
STRUCTURE TO ABUTMENT/EMBANKMENT JUNCTIONS N/A		
DRAINS N/A		
WATER PASSAGES N/A		
FOUNDATIONS N/A		

CONCRETE/MASONRY DAMS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS AND RECOMMENDATIONS
SURFACE CRACKS CONCRETE SURFACES N/A		
STRUCTURAL CRACKING N/A		
VERTICAL & HORIZONTAL ALIGNMENT N/A		
MONOLITH JOINTS N/A		
CONSTRUCTION JOINTS N/A		

VISUAL EXAMINATION OF	EMBANKMENT OBSERVATIONS	REMARKS AND RECOMMENDATIONS
SURFACE CRACKS None noticed.		
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE None observed.		
SLOUGHING OR EROSION OF EMBANKMENT AND ABUTMENT SLOPES No sloughing or erosion was visible.		
VERTICAL & HORIZONTAL ALIGNMENT OF THE CREST Good.		
RIPRAP FAILURES None		

VISUAL EXAMINATION OF	EMBANKMENT OBSERVATIONS	REMARKS AND RECOMMENDATIONS
	Main spillway: Has grass (trimmed) growing on earth embankment. No trees or vegetation growing on embankment. Auxiliary spillway: Embankment is natural ground.	
JUNCTION OF EMBANKMENT AND ABUTMENT, SPILLWAY AND DAM N/A for main spillway which is a drop inlet. Good condition for auxiliary spillway.		
ANY NOTICEABLE SEEPAGE Minor seepage was visible on the parking area pavement, downstream side of embankment, approximately opposite the main spillway.		Monitor seepage for clearness and quantity.
STAFF GAGE AND RECORDER None		
DRAINS None		

OUTLET WORKS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS AND RECOMMENDATIONS
CRACKING & SPALLING OF CONCRETE SURFACES IN STILLING BASIN	N/A. Main spillway (also the outlet works) discharges into Darlington Brook. Auxiliary spillway discharges into Lower Swimming Lake.	
INTAKE STRUCTURE	Main spillway is a drop inlet structure with a sluice gate. Recently constructed, all are in excellent condition.	
N/A to auxiliary spillway.		
OUTLET STRUCTURE	60-inch diameter reinforced concrete pipe, in excellent condition, is low-level outlet from drop inlet structure (main spillway).	
OUTLET FACILITIES	None	
EMERGENCY GATE	None	

VISUAL EXAMINATION OF	UNGATED SPILLWAY OBSERVATIONS	REMARKS AND RECOMMENDATIONS
<p>CONCRETE WEIR</p> <p>Main spillway is a drop inlet structure with a sluice gate, recently constructed and in excellent condition.</p> <p>Auxiliary spillway is concrete in good condition. Slight seepage was visible at its base.</p>		<p>Monitor seepage for clearness and flow quantity.</p>
<p>APPROACH CHANNEL</p> <p>Reservoir, the Boating Lake, is the approach channel for both spillways.</p>		
<p>DISCHARGE CHANNEL</p> <p>Main spillway: 60 inch reinforced concrete pipe, in excellent condition, is discharge channel and low-level outlet.</p> <p>Auxiliary spillway: The Lower Swimming Lake is the discharge channel. Its right side slope is reinforced by a gabion wall. All in good condition.</p>		
<p>BRIDGE AND PIERS</p> <p>N/A for main spillway.</p> <p>Auxiliary spillway: Wooden plank bridge supported by concrete piers. All in good condition.</p>		

GATED SPILLWAY OBSERVATIONS

VISUAL EXAMINATION OF	REMARKS AND RECOMMENDATIONS
CONCRETE SILL N/A	
APPROACH CHANNEL N/A	
DISCHARGE CHANNEL N/A	
BRIDGE AND PIERS N/A	
GATES & OPERATION EQUIPMENT N/A	

INSTRUMENTATION OBSERVATIONS		REMARKS AND RECOMMENDATIONS
VISUAL EXAMINATION OF MONUMENTATION/SURVEYS None		
OBSERVATION WELLS None		
WEIRS None		
PIEZOMETERS None		
OTHER None		

RESERVOIR

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS AND RECOMMENDATIONS
SLOPES	Flat to moderate. No indication of slope instability.	
SEDIMENTATION	None visible.	

DOWNSTREAM CHANNEL

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS AND RECOMMENDATIONS
CONDITION (OBSTRUCTIONS, DEBRIS, ETC.)	Condition of channel good. Approximately 50 feet from where the low-level outlet (60 inch R.C.P.) empties into the downstream channel (Darlington Brook), the channel flows under an access road near the Parking Area within the Park grounds.	
SLOPES	Mostly 2H:1V and wooded. Good condition.	
APPROXIMATE NUMBER OF HOMES AND POPULATION	There is a Parking Area at the toe of the downstream side of the embankment. There are four houses on the channel's left bank. They are located approximately a half mile downstream from the embankment on Darlington Avenue.	

CHECK LIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION

ITEM	REMARKS
PLAN OF DAM	Available on microfilm at N.J. Department of Environmental Protection (NJ-DEP), 1474 Prospect Street, P.O. Box CN-029, Trenton, NJ 08625
REGIONAL VICINITY MAP	Available - Bergen County Map and U.S.G.S. Quadrangle Sheet for Ramsey, New Jersey - New York
CONSTRUCTION HISTORY	No formal history exists, but it can be deduced from available microfilm at NJ-DEP.
TYPICAL SECTIONS OF DAM	Available on microfilm at NJ-DEP.
HYDROLOGIC/HYDRAULIC DATA	Available for original construction of auxiliary spillway only, on microfilm at NJ-DEP.
OUTLETS - PLAN	Available at Bergen County Park Commission, 327 Ridgewood Avenue. Paramus, NJ 07652
- DETAILS	Available at Bergen County Park Commission
- CONSTRAINTS	None
- DISCHARGE RATINGS	Not available.
RAINFALL / RESERVOIR RECORDS	Not available.

CHECK LIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION
(continued)

ITEM	REMARKS
DESIGN REPORTS	None available.
GEOLOGY REPORTS	Available U.S.G.S. Geologic Overlay Sheet for Bergen County and Engineering Soils Survey of New Jersey, Report No. 4 - Bergen and Hudson Counties, by Rutgers University (New Brunswick, N.J.)
DESIGN COMPUTATIONS HYDROLOGY & HYDRAULICS DAM STABILITY SEEPAGE STUDIES	Limited hydrological and hydraulic data.
MATERIALS INVESTIGATIONS BORING RECORDS LABORATORY FIELD	None available.
POST-CONSTRUCTION SURVEYS OF DAM	None
BORROW SOURCES	Unknown.
SPILLWAY PLAN - SECTIONS - DETAILS	Main spillway at Bergen County Park Commission. Auxiliary spillway on microfilm at NJ-DEP.

CHECK LIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION
(continued)

ITEM	REMARKS
OPERATING EQUIPMENT PLANS AND DETAILS	Bergen County Park Commission
MONITORING SYSTEMS	None available.
MODIFICATIONS	Dror inlet spillway and low-level outlet 1978. Auxiliary spillway modified.
HIGH POOL RECORDS	Not kept.
POST CONSTRUCTION ENGINEERING STUDIES AND REPORTS	Existing condition report - July 14, 1971
PRIOR ACCIDENTS OF FAILURE OF DAM - DESCRIPTION - REPORTS	None known to exist.
MAINTENANCE OPERATION RECORDS	None known to exist.

APPENDIX B

PHOTOGRAPHS

DARLINGTON LAKE DAM



Photo 1 - View of embankment looking toward its right edge. At lower right is portion of the main spillway. A portion of the Parking Area, the downstream toe of the embankment, is visible at left center. Building at top left is Main Gate House. (Photo taken on February 8, 1980).



Photo 2 - Detail of the main spillway, a drop inlet with a sluice gate, also called the low level outlet. The handwheel, top center, operates the gate. (Photo taken on February 8, 1980).

DARLINGTON LAKE DAM



Photo 3 - View showing the outlet end of the low level drain, a 60 inch R.C.P., which is a part of the main spillway. The discharge channel, Darlington Brook, is in the foreground. Downstream is left. (Photo taken on February 8, 1980).



Photo 4 - View of downstream channel, also known as Darlington Brook, from upstream at vicinity of the 60 inch R.C.P. mentioned in Photo 3. Bridge is approximately 50 feet from the R.C.P. The Parking Area is out of photo on viewer's right. (Photo taken on February 8, 1980).

DARLINGTON LAKE DAM



Photo 5 - View toward the auxiliary spillway. Portion of lake is shown at right. Beyond the spillway is the Lower Swimming Lake. Building at right is the Main Lodge. (Photo taken on December 3, 1979).



Photo 6 - View toward the auxiliary spillway from the Lower Swimming Lake. Note gabion wall at left center. (Photo taken on December 3, 1979).

APPENDIX C

SUMMARY OF ENGINEERING DATA

CHECK LIST
HYDROLOGIC AND HYDRAULIC DATA
ENGINEERING DATA

Name of Dam: DARLINGTON LAKE DAM

Drainage Area Characteristics: 2.25 square miles

Elevation Top Normal Pool (Storage Capacity): 320 NGVD (66 acre-feet)

Elevation Top Flood Control Pool (Storage Capacity): N/A

Elevation Maximum Design Pool: 322.14 NGVD (SDF pool: 147 acre-feet)

Elevation Top Dam: 324.5 NGVD (236 acre-feet)

SPILLWAY CREST: Main: 320 NGVD
 a. Elevation Auxiliary: 322.8 NGVD
 Main: Concrete Drop Inlet
 b. Type Auxiliary: Concrete Broad Crested Weir
 Main: 9.53 feet
 c. Width Auxiliary: 1.2 feet
 Main: 30.4 feet
 d. Length Auxiliary: 134 feet
 Both sides and front -Main
 e. Location Spillover Center -Auxiliary
 f. No. and Type of Gates None

OUTLET WORKS:

a. Type 60-inch R.C.P.
 b. Location At main spillway
 c. Entrance Inverts 309.5 NGVD
 d. Exit Inverts 306.8 NGVD
 e. Emergency Draindown Facilities 48 ft. sluice gate 60-inch R.C.P.

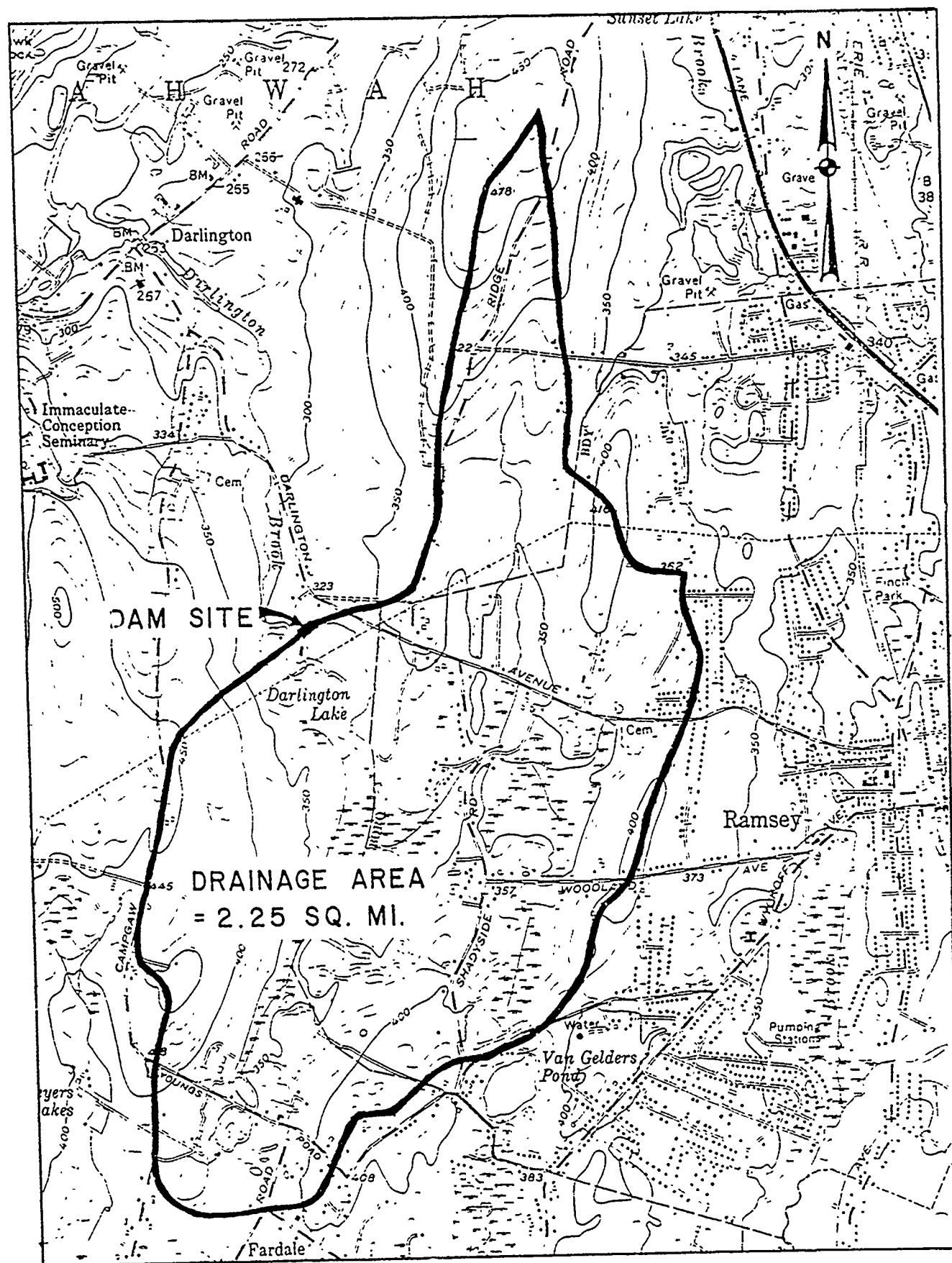
HYDROMETEOROLOGICAL GAGES:

a. Type None
 b. Location None
 c. Records None

MAXIMUM NON-DAMAGING DISCHARGE: 1073 cfs at elevation 324.5 NGVD

APPENDIX D

HYDROLOGIC COMPUTATIONS



2,000 0 2,000 4,000

Scale: 1" = 2,000 FT.

DARLINGTON LAKE DAM DRAINAGE BASIN

PRC Harris, Inc.
CONSULTING ENGINEERS

SUBJECT N.J. DAM SAFETY INSPECTION
DARLINGTON LAKE DAM
COMPUTED BY C.L.C. CHECKED BY B.K.

SHEET NO. 1 OF 8
JOB NO. 10-A83-01
DATE 1-14-80

GROUP XVII

DARLINGTON LAKE DAM (N.J. 00230)

SIZE CLASSIFICATION

Main Impoundment Surface Area

18.7 Acres

Average Depth of Lake

3 ft ±

Structural Height of Dam

19 ft

Size Classification

Small

HAZARD POTENTIAL CLASSIFICATION

2 Building and parking lots immediately D/S of Dam with
Approx. 30 people in these buildings during season and full of people in
park lot.

Hazard potential

Significant

Recommended SDF

100 Yrs

HYDROLOGIC ANALYSIS

Flood Routing will be computed by HEC-1 DB Computer
Program Using SCS Triangular Unit Hydrograph with Curvilinear
Transformation

D.A. = 2.25 SQ. MI.

PRC Harris, Inc.

CONSULTING ENGINEERS

SUBJECT N.J. DAM SAFETY INSPECTION

Darlington Lake Dam

COMPUTED BY C.H.C. CHECKED BY R.K.

SHEET No 22 OF 8

JOB No 10-ABS-01

DATE 4/18/80

100-Yr Flood calculated by Special Report 38
Darlington Dam:

$$D.A. = 2.25 \pm 0.11.$$

$$\text{Main channel Slope: } \frac{410 - 32.0}{2.42 - 0.28} = 42.06 \text{ ft/mi}$$

Impervious Index; I:

Population Density:

$$\text{in Mahwah: } 12303/25.7 = 498.$$

$$\text{in Ramsey: } 12272/5.9 = 2080$$

$$\text{Weighted D: } \frac{0.9(2080) + 1.35(498)}{2.25} = 1131 \text{ persons/mi}$$

$$I = 0.117(1131)^{0.792 - 0.0392D} = 13.27$$

$$\text{Storage} = 0.27 \text{ sq mi.}$$

$$St = 0.27/2.25 = 12\%$$

$$Q_{100} = 136 A^{.84} S^{.26} Se^{-.51} I^{.14}$$

$$= 136 (1.98) (2.64) (0.28) (1.44) = 288 \text{ cfs}$$

Ref. Magnitude & Frequency of Floods in NJ with
effects of Urbanization Special Report #38 by
NJ DEP & USGS

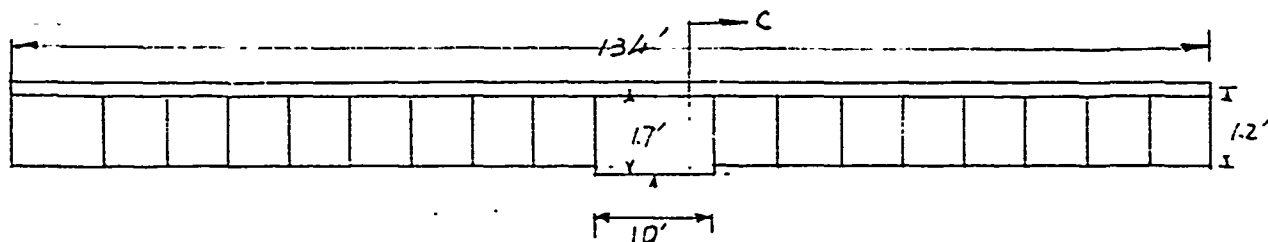
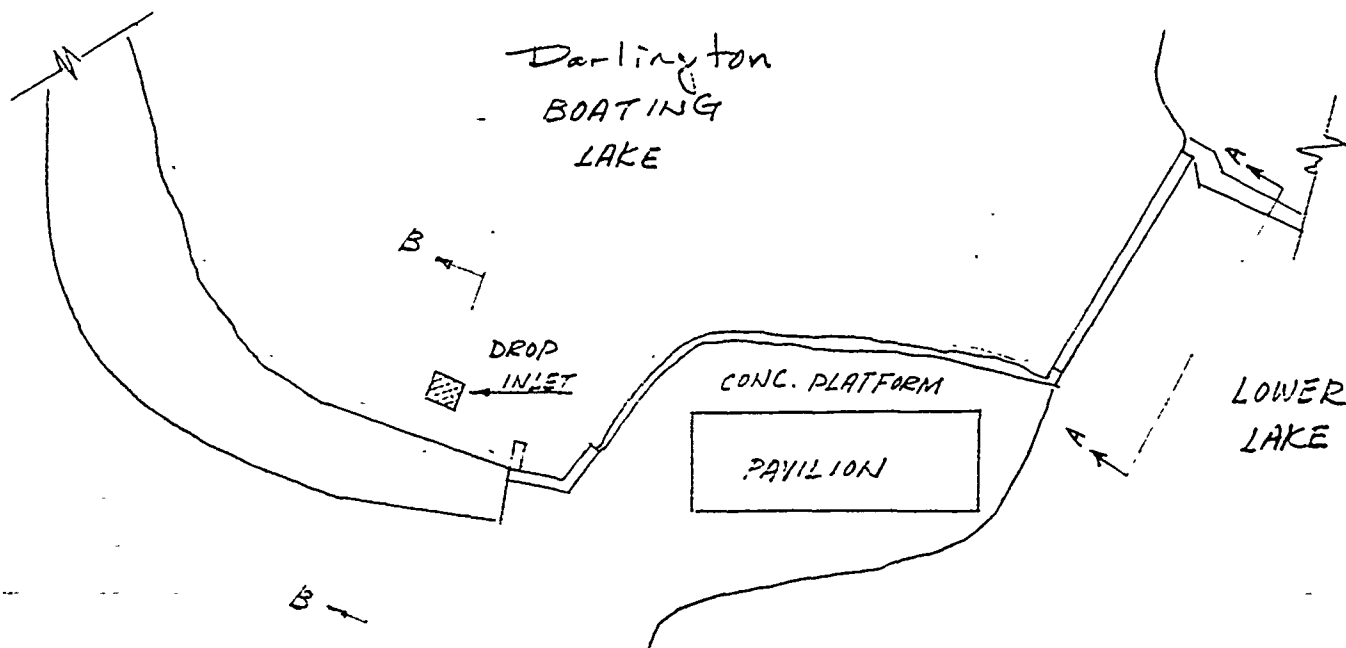
ELEVATION - AREA - CAPACITY RELATIONSHIP

Data Estimated From U.S.G.S. Map

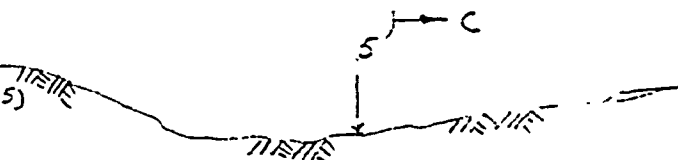
Elevation (F.T.)	[*] 311.4	320	330	340
Surface Area (Ac)	0	22.96	112.0	175.4

* Estimated Lake bottom Elevation at Spillway

HEC-1 DB Program will develop storage - capacity relationship from surface area & elevations.

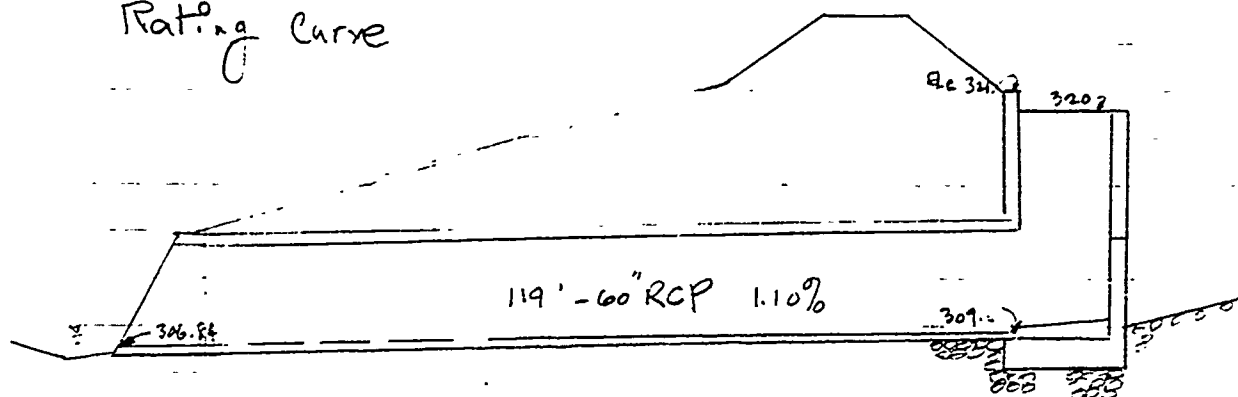


* 17 piers w/1.5' width
Total net length $134 - (17 \times 1.5)$
 $= 108.50'$



SECTION A-A

Rating Curve



1. to compute port and weir discharge rating
2. to compute full pipe flow discharge
3. to compute orifice discharge at the pool elev. where weir flow and full pipe flow intersect.

$$n = 0.013$$

$$D = 5' 0" \quad L = 119' \quad S = 1.1\% \quad A_p = 19.63 \text{ ft}^2$$

$$\begin{aligned} \text{Net length } L &= 2 \times 6 + 9.21 = 21.2' \quad H \leq 1' & Q = CLH^{1.5} \\ \text{Net length } L &= 2 \times 6 + 2 \times 9.21 = 30.4' \quad H > 1' \end{aligned}$$

Assume broad crest weir with 1.5' width
table 5-3, Knight & Brater

	h	C	L	$Q = CLH^{1.5}$
321	1	2.75	$2 \times 6 + 9.21 = 21.2'$	58.3
322	2	3.03	$2 \times 6 + 9.21 \times 2 = 30.4'$	260.5
323	3	3.32	30.4	524.4
324	4	3.32	30.4	807.4
325	5	3.32	30.4	1128

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SUBJECT NJ Dam Safety Insp. Group VII
Parlinton Lake Dam
COMPUTED BY PK CHECKED BY CLC

SHEET NO. 5 OF 58
JOB NO. 10-455-01
DATE 2/12/80

Rating Curve - Continued
The full pipe flow discharges are obtained from Fig. B-8 pg 565 Design of Small dam
Assume The Ave. Elev of Top of Dam is 324.5, L = 470', C = 2.70 HEC-2 User Manual

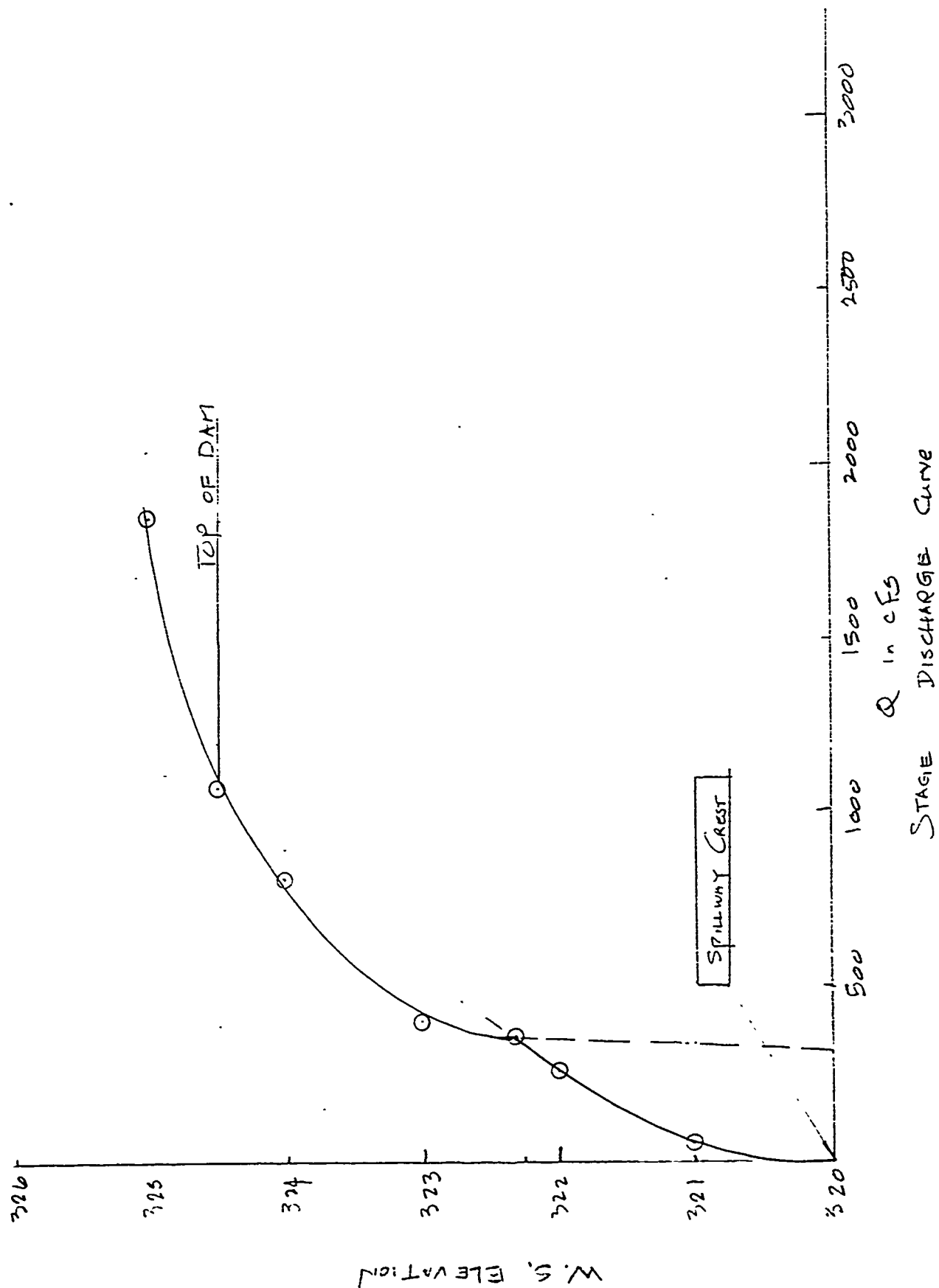
W.S. Elev	Weir Flow of Drop Inlet			Pipe Flow			Weir Flow over dam				Weir Between Battering & Low Swimming Pool			Total Q
	L	H	Q=CLH ^{1.5}	$\frac{h}{D}$	Q Hg B-8 Small Dam	C	L	h	Q=CLH ^{1.5}	Notch CL H 2.7 4.0	CxL C=2.7 L=165	H	Q CL H ^{1.5} =361.8 Q	
320			0	2.2	310									= 58
321	2.75	1.0	58.3	2.4	330									= 261
322	3.03	2.0	260.5	2.6	350									= 357
322.37	3.21	2.0	357.4	2.7	357									= 410
323	3.32	3.0	524.4	2.8	370				27	0.7	264	0.2	24	370+16+24
324				3.0	390				27	1.7	266	1.2	350	390+60+350 = 800
324.5				3.1	395				27	2.2	266	1.7	590	395+88+590 = 1073
325				3.2	400	2.7	470	0.5	27	2.7	266	2.2	668	400+499+120+668 = 1937
326				3.4	420	2.7	470	1.5	27	3.7	266	3.2	1522	420+233+1924 1522-9965

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SUBJECT NT Dam Safety Prog. Group IV
DARLINGTON Lake Dam
COMPUTED BY BK CHECKED BY CLC

SHEET NO. 6 OF 68
JOB NO. 18-A-01
DATE 2/12/80

RATING CURVE: CONTINUED



Drawdown Time computation:
Law Outlet calculations: —

$$Q_g = A_g \sqrt{\frac{2gh}{\Sigma K + 1}}$$

$$A_g = 4' \times 4' = 16 \text{ sq'} \text{ (slide gate)}$$

$$\frac{1}{\sqrt{F}} = 210 \sqrt{\frac{P}{2K_3}} + 1.74$$

$K_s = 0.002$ Circular Concrete Pipe
 $K_s = 0.003$ rectangular conc. conduits
 $f_1 = 0.0154$ $f_2 = 0.0159$

$$= \text{value}_1 + \Sigma K$$

$$1 + \Sigma K = 1 + K_o + K_{exp} + K_{con} \left[\frac{f_2 L_2}{P} \right]$$

$K_0 = 0.5$ (P. 5.5-6, Eng H.B. Section 5 SCS)

$$1K_{0.5} = 0.65 \text{ (15.5-7)}$$

$$K_c = 5,40$$

$$1 + \bar{2}K = 1 + 0.5 + 0.65 + 0.4 + \dots \frac{0.0159 \times 120}{5} = 2.93$$

Ave outlet discharge $Q_g = A_p \sqrt{\frac{2gh}{\Sigma K + 1}}$

$$= A_p \times 4.69 \sqrt{h} = 74.99 \sqrt{h}$$

ele.	h	Q	P
319	9.8	235	
317	7.8	209	
315	5.8	$\frac{H}{B}$	181
313		0.88	66
311.7		0.55	32
309.2			

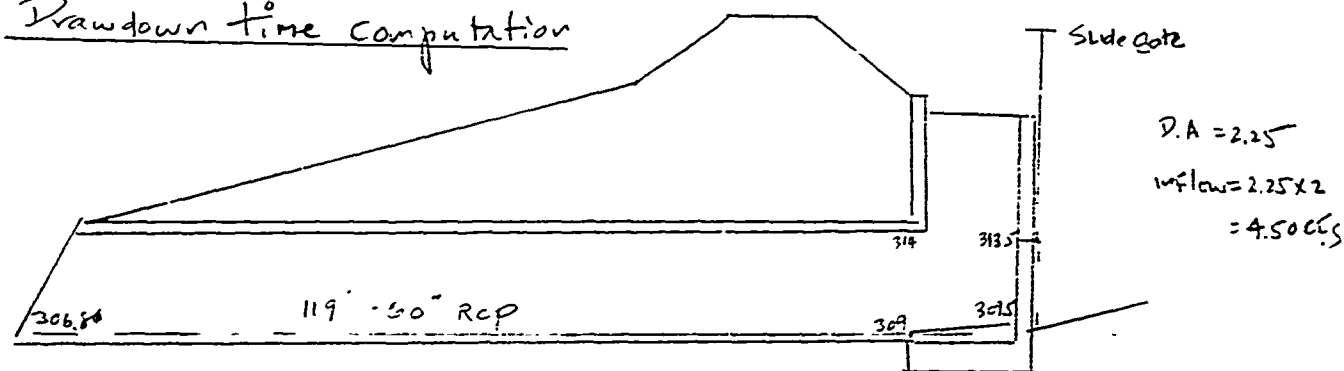
use Fig B-8, p. 565 Design of small Dam
for partial flow

FREDERIC R. HARRIS, INC.
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SUBJECT N.J. Dam Safety Prog. Group XVII
Darlington Lake Dam
COMPUTED BY P.K. CHECKED BY CLC

SHEET NO. 8 OF 8
JOB NO. 10-AR3-03
DATE 2/13/80

Drawdown time computation



The opening of slide gate is 4' x 4' (according to the drawing H-32-1699F)

Res. Elev.	Area Ac	Ave Area	Vol Ac-ft	Ave Ele	Ave Q Cfs	t ₁ time of drawdown $\frac{Vol \times 2.25}{1.47 Q}$	Cul time hr	t ₂ with inflow $4.5 \times \frac{t_1}{Q}$	Cul time hr
320	23								
318	13.09	18.05	36.09	310	235	1.86	1.86	0.04	1.90
316	6.36	9.73	19.46	317	209	1.13	2.99	0.02	3.05
314	2.03	4.20	8.40	315	181	0.56	3.55	0.01	3.62
312	0.11	1.07	2.14	313	66	0.39	3.94	0.03	4.04
311.4	0	0.06	0.4	311.7	32	0.15	4.09	0.02	4.21
309.2	0								

A) Time of complete drawdown with no inflow = 4.09 hr

B) Time of complete drawdown with 4.5 cfs inflow = 4.21 hr

$$\left(A_1 \approx \frac{A_2}{\left(\frac{n}{n+1} \right)^2} \right) \quad A_2 = 23 \text{ ac} \quad h + H_F = 8.6$$